GENERATION, TRANSMISSION AND APPLICATION OF THE POWER SERVICES

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MAINTENANCE TIPS · 115

Power

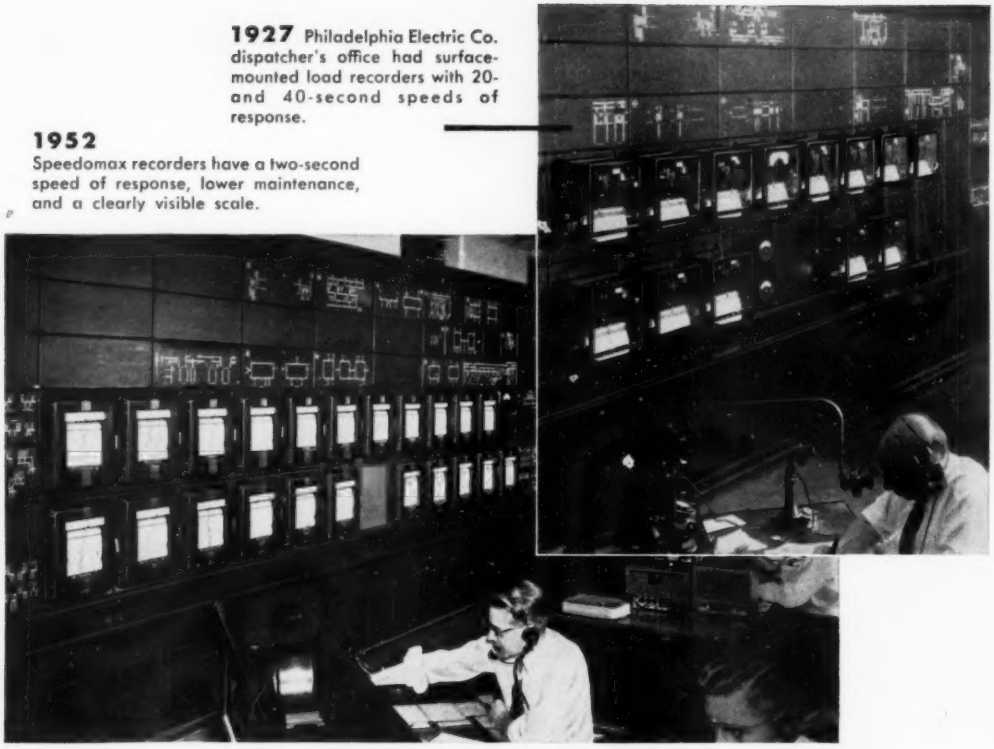
May
1952 · 50¢

A McGRAW-HILL PUBLICATION

New ideas in pulp-and-paper power — 88

1927 Philadelphia Electric Co. dispatcher's office had surface-mounted load recorders with 20- and 40-second speeds of response.

1952
Speedomax recorders have a two-second speed of response, lower maintenance, and a clearly visible scale.



25 years in the making...

If you had been a load dispatcher in the Philadelphia Electric Co. operating room back in 1927, you would have had system information that few men could match. With Leeds & Northrup load recorders to focus system operating data before your eyes, you were ready for problems in meeting customer demand, allocating generation for optimum economy, and maintaining proper interchange with your neighboring utility in Delaware.

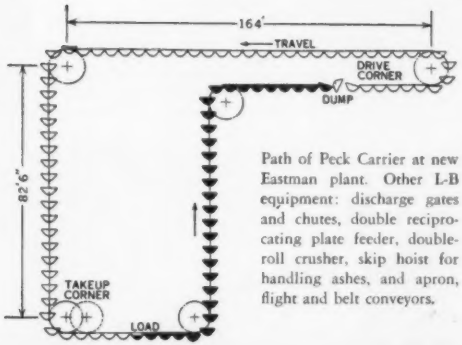
Today, the equipment in that same dispatcher's office has grown out of 25 years of actual operating experience. It reflects the refinements of system operating techniques made by Philadelphia Electric and many other utilities. These refinements were a major factor in the continuing improvement of the original L&N telemetering equipment, and the development of additional instruments totally unknown 25 years ago. Result: the change from the old to the new has been a carefully planned transition—not a makeshift "advance."

For data on telemetering which is in phase with utility requirements, write to our nearest office, or 4910 Stenton Avenue, Phila. 44, Pa.

LEEDS & NORTHRUP CO.
INSTRUMENTS • AUTOMATIC CONTROLS • FURNACES

Jet Ad ND46-58-461(5)

Eastman repeats after 22 years ...orders another Peck Carrier!



Path of Peck Carrier at new Eastman plant. Other L-B equipment: discharge gates and chutes, double reciprocating plate feeder, double-roll crusher, skip hoist for handling ashes, and apron, flight and belt conveyors.

Proof that LINK-BELT's unified responsibility cuts power plant coal handling costs

When Eastman Kodak Co. enlarged their Rochester (N.Y.) power plant recently, they again called in Link-Belt. They wanted the same efficient coal handling they are getting in their 1929-built plant, to assure uninterrupted supply of process steam 24 hours a day.

The new system—also built around a Link-Belt Peck Carrier—handles 130 tons of coal per hour. Because the Peck Carrier moves coal vertically as well as horizontally, without transfer points, all costs are extremely low—initial, operating and maintenance.

Eastman's versatile carrier can be emptied over a belt conveyor by a stationary tripper to serve the old steam plant. Or, with a movable tripper, coal can be discharged at any point on the upper run to fill the new bunkers uniformly.

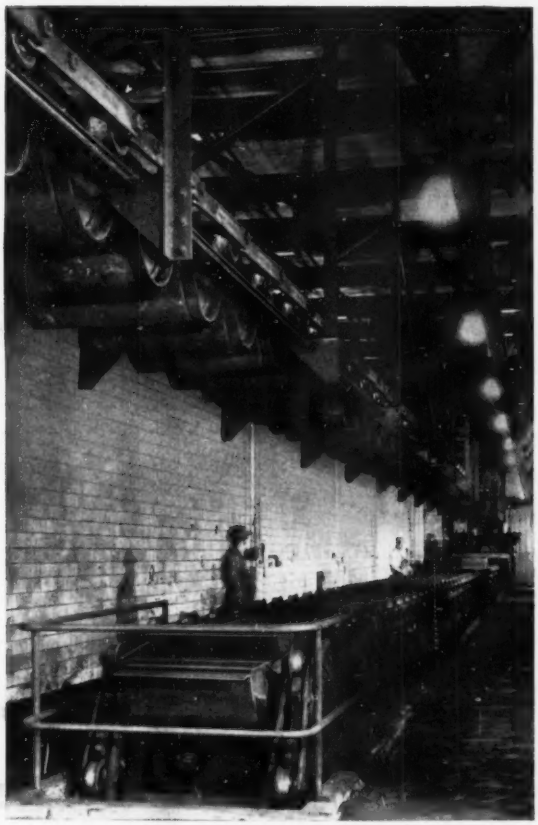
Remember, too, Link-Belt designs and builds complete coal handling systems for large or small plants. One source . . . one responsibility. Ask your Link-Belt representative for a copy of new Power Plant Book 2410.

LINK-BELT

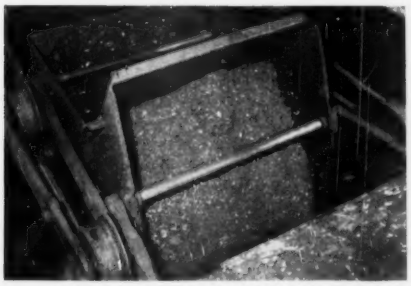
COAL HANDLING EQUIPMENT

LINK-BELT COMPANY: Chicago 9, Indianapolis 6, Philadelphia 40, Atlanta, Houston 1, Minneapolis 5, San Francisco 24, Los Angeles 33, Seattle 4, Toronto 8, Springs (South Africa), Sydney (Australia). Offices in Principal Cities.

12,774

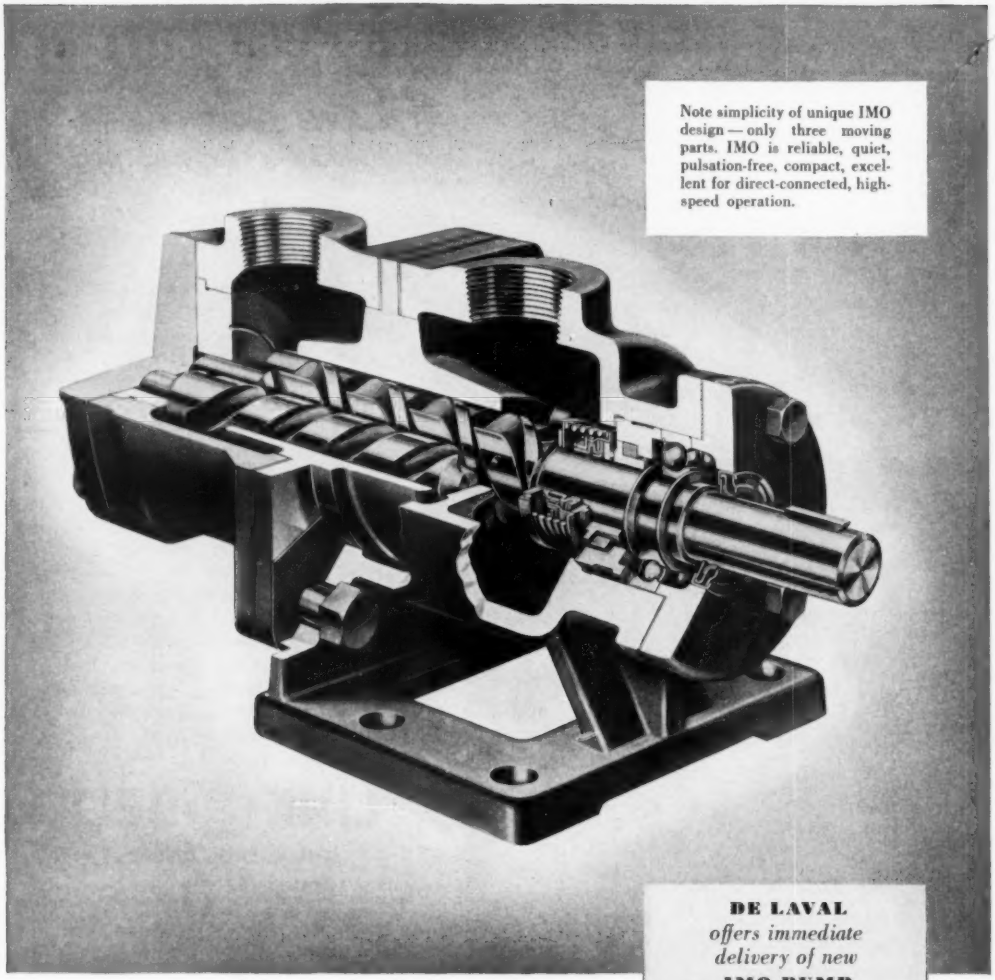


Upper horizontal run of Peck Carrier serves new coal bunkers. Use of L-B Electrofluid Drive cuts motor size from 30 to 20 hp.



Note full loading of buckets being automatically discharged by tripper. Buckets stay horizontal in any travel direction.

Newest IMO pump – Greatest savings



Note simplicity of unique IMO design — only three moving parts. IMO is reliable, quiet, pulsation-free, compact, excellent for direct-connected, high-speed operation.

DE LAVAL
offers immediate delivery of new
IMO PUMP
Write today

DL 147

This newest De Laval IMO pump — Model A313B — can be used profitably on a wide variety of hydraulic applications for higher pressures. Quantity-produced to help trim your costs, the new IMO saves you up to 40% in initial cost over other IMO models for pressures up to 275 psi. In addition, this quality-designed rotary positive displacement pump gives you all the low-maintenance advantages of the famous IMO pumping principle.

Put the new De Laval IMO A313B pump to work handling light or viscous fluids in hydraulic systems, rotary and steam atomizing oil burners, lubrication, governing systems and similar services. Specify it for capacities to 80 gpm, pressures to 275 psi and intermittent pressures to 325 psi.

DE LAVAL *IMO Pumps*

DE LAVAL STEAM TURBINE COMPANY
Trenton 2, New Jersey

Power

MAY . 1952 • VOLUME 96 NUMBER 5

MAKING PULP AND PAPER takes plenty of steam and power. The Coosa River Newsprint Co, where Bill Hedrich of Hedrich-Blessing Studio took the night shot that forms our cover, is a good example. This plant, at Coosa River, Ala., produces 450,000 lb per hr of 600-psi steam, uses 15,000 gpm of water. Its powerhouse, rear of picture, boasts 30,000 kw of generator capacity. Kiln in foreground burns lime, is part of liquor-recovery system.

With power services bulking large in production costs, engineers of this fast-growing industry put plenty of thought into plant design. Survey beginning on p 88 reveals where that thinking leads—toward higher pressure and temperature, of course, fewer, bigger boilers, better use of waste fuels, greater fuel flexibility.

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POWER articles are indexed in both the *Industrial Arts Index* and the *Engineering Index*. POWER publishes its own annual index, which is available for 50¢ from the editorial offices.

Next month . . .

■ June brings you another practical handbook. Dealing with transformers, it begins by telling how they work and what they'll do. Then come dope on construction (both liquid-filled and dry types), pointers on applying transformers and maintaining them in top operating condition.

■ A timely Operator's Notebook lines up roof-cooling methods, tells what they'll do to take the heat off your plant.

■ No matter what kind of plant you have, there's bound to be a pump in it (probably plenty of 'em). So keep an eye out for our upcoming A-to-Z picturization of pump maintenance. It's based on a new Allis-Chalmers slide film, is just about tops.

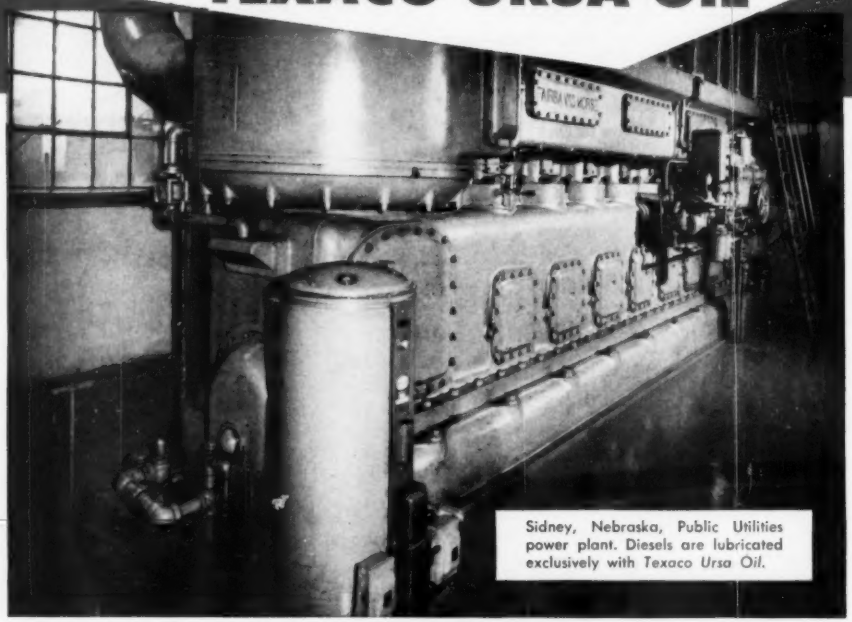
■ A good "plant story" probes behind the facts to bring you the why's of the design. The June article on Southern California Edison's Etiwanda station does just that for an extremely interesting layout.

. . . and future months

Lots of POWER readers liked our use of "dimetric" drawings, took us up on our offer to tell how to make them. We're readying the piece now—you'll see it in an early issue.

Use the lube that SAVES THE FUEL...

TEXACO URSA OIL



Sidney, Nebraska, Public Utilities power plant. Diesels are lubricated exclusively with *Texaco Ursa Oil.*

OPERATING records from all parts of the country show *truly low* fuel consumption for Diesel, gas and dual-fuel engines lubricated with *Texaco Ursa Oil.* And *truly low* maintenance costs, too.

Texaco Ursa Oil's "built in" resistance to oxidation and ability to stand up under extreme heat and pressure keep engines running clean. Rings stay free, ports stay clear, valves work properly — unhampered by harmful formations of carbon, sludge and gum. Results: better compression and combustion for lower fuel consumption; less wear and smoother operation for lower maintenance costs.

Leading engine builders approve *Texaco Ursa Oils,* and there is a complete line to assure top performance from every type and size of Diesel engine. That's why —

For over 15 years, more stationary Diesel h.p. in the U.S. has been lubricated with Texaco than with any other brand.

You'll find it worth your while to talk to a Texaco Lubrication Engineer. Just call the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States, or write The Texas Company, 135 East 42nd Street, New York 17, N. Y.

TEXACO URSA OILS

FOR ALL DIESEL, GAS AND DUAL-FUEL ENGINES

Faithfully yours 50 *for Fifty Years*

TUNE IN . . . TEXACO STAR THEATER starring MILTON BERLE on television every Tuesday night. See newspaper for time and station.

Power

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...with Power readers...

FIREMAN—FIRST CLASS . . .

"Nothing I've seen yet has brought home to me the truly tremendous potential of atomic power the way the picture and editorial in last month's issue did (April, p 69). A 'fireman' holding more than 15,000 tons of coal in one hand is really something! And then you did a swell job of bringing me back to the real problems of making atomic power pay by spelling out the economics in simple, clear terms. It was a fine editorial and you're to be congratulated on it."

San Diego, Calif. J F BLACKMIN

AUTHORS ARE READERS, TOO . . .

We editors have a double-barreled relationship with many of our friends—they are both authors and readers. Here's an excerpt from a recent letter Dick Godfrey ("bylined" on this page) sent to Associate Editor Steve Elonka. We are glad to get his reactions to the new *George Edwards* series and also to learn how he and his associates make good use of POWER. We'd like to know how other readers pass along the benefits of POWER to their operating staffs—how about dropping us a line?—ED.

"I've been putting off answering your note until my March POWER *arrived so I could see the* George Edwards *editorial*

(*Continued on page* 218)

...lines and bylines

J E Tobey

GETTING THE FACTS is a passion with Julian Tobey. As chief engineer of power plants for Studebaker, he tested coal from 120 mines before he picked the best for his plant. And after 20 years it was still doing a bang-up job. When water treatment proved inadequate, he used several gallons of red ink to trace water action in the softener, solved the problem.

One of his first jobs with Appalachian Coals, Inc was to compile results of a survey of 15,000 boiler units in 20 states. Similar zeal for fact-finding marked later work as managing director of Fairmont Coal Bureau, contributed to advancement of fuel engineering.

Now, as president of Appalachian Coals, Inc, Julian continues to direct numerous suveys. One of the latest—on power-design trends in the pulp and paper industry—is reported on pp 88-91.

Roy Carter

PUMP Q & A, our popular series of some years back, put Roy Carter into high gear as a writer. Since then he has appeared in print many times, often with his writing partner, Igor Karassik (about Igor, more later).

From his home town, Scranton, Pa., Roy entered Columbia University, whose 6-yr program gave him a chance to decide if he really wanted to be an engineer. He did, won his ME in 1923.

An interest in hydraulic turbines took Roy to Worthington Corp. But by the time they discontinued this work, Roy had picked up the enthusiasm for centrifugal pumps he holds to this day. In almost 20 years at Worthington, Roy has tackled just about every phase of pump engineering, with recent emphasis on application problems (see p 102). Prime hobby outside of pumps is growing vegetables and strawberries, trying new freezing methods.

R P Godfrey

TROUBLE STARTED Dick Godfrey on a career in refrigeration. A graduate of Massachusetts Maritime Academy in 1939, he put in four years at sea, a year teaching at the U.S. Merchant Marine Academy at King's Point, and then shipped out again as Chief.

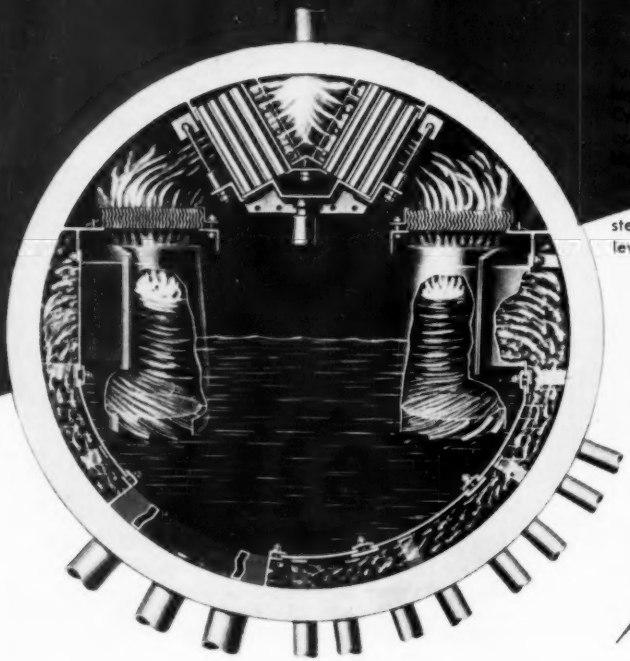
On his first trip, a tube split in the refrigeration condenser, filling the system with sea water. Unable to get the unit cleaned, dehydrated and filled with Freon, he fought it for four months and had it limping along with all boxes cold when he got back to the States. Carrier Corp did the repair work, offered Dick a job on the strength of his ability to "make do." Out of the service in 1946, he took up their offer, served as field engineer.

Dick has been in the "cold" business ever since. Right now he handles refrigeration for John H Dulany & Sons food-freezing plant and 3-million-lb cold-storage. So when he writes on the practical angles of refrigeration (see p 126), he knows whereof he speaks.

OUR APOLOGIES to Don Given, "bylined" on this page last month. A typographical error had him graduating in 1924 instead of 1942!

14 YEARS

of operating experience with STEAM over 2000 PSI



...is typical of ...which B&W's progres... ...research pushes the science of steam generation to ever higher levels of economy.

For those seeking the high steam-cycle efficiencies obtainable with steam pressures over 2000 psi, B&W offers unparalleled design and operating experience . . . drawing upon a background extending over the last 14 years with units to serve over 8,000,000 kilowatts of generating capacity.

The outstanding performance records of the 12 B&W installations already operating in this range have given strong impetus to the present trend toward use of pressures over 2000 psi . . . have resulted in orders for more than 50 additional B&W units with design pressures up to 2700 psi.

B&W's many years of experience in designi.ıg and building boilers for economical, high-pressure steam generation, as exemplified in the list on the opposite page, are at your service.

B&W BOILERS WITH DESIGN PRESSURES OVER 2000 PSI

Owner	Boiler Design Pressure
Diamond Alkali Co.	2200
Indiana & Michigan Electric Co.	2650
Appalachian Electric Power Co.	2300
Indiana & Michigan Electric Co.	2300
The Ohio Power Co.	2300
Commonwealth Edison Co.	2125
Indiana & Michigan Electric Co.	2300
Appalachian Electric Power Co.	2300
Commonwealth Edison Co.	2125
The Ohio Power Co.	2300
Public Service Co. of No. Illinois	2050
Indiana & Michigan Electric Co.	2300
Consolidated Edison Co. of N. Y.	2050
Philadelphia Electric Co.	2075
Consolidated Edison Co. of N. Y.	2050
Pennsylvania Electric Co.	2080
Philadelphia Electric Co.	2075
Detroit Edison Co.	2050
Appalachian Electric Power Co.	2400
Commonwealth Edison Co.	2125
Tennessee Valley Authority	2050
Commonwealth Edison Co.	2125
Detroit Edison Co.	2050
Jersey Central Power & Light Co.	2225
Georgia Power Co.	2100
Southern California Edison Co.	2050
Narragansett Electric Lighting Co.	2350
Public Service Co. of No. Illinois	2125
Tennessee Valley Authority	2050
Ohio Edison Co.	2300
Pacific Gas & Electric	2050
Public Service Elec. & Gas	2700
Appalachian Electric Power Co.	2400
Tennessee Valley Authority	2050
Tennessee Valley Authority	2050
Georgia Power Company	2100
Tennessee Valley Authority	2050
The Ohio Power Co.	2400
The Ohio Power Co.	2400
Ohio Edison Co.	2300

TOTAL GENERATING CAPACITY SERVED: OVER 8,000,000 KILOWATTS.

G-563T

PROOF
OF SUPERIOR BOILER CLEANING

A report issued by the Federal Power Commission in November, 1951 includes the "Average Btu per Kilowatthour Net Generation" in 1950 of 264 power stations throughout the country.

Of the 25 having the lowest heat rates, 23 were equipped with Diamond Blowers.

It is impossible to maintain a low heat rate unless boilers are kept clean. Diamond has 49 years experience in boiler cleaning . . . has the equipment and the knowledge of blower application to assure correct boiler cleaning . . . and at lowest overall cost.

DIAMOND POWER SPECIALTY CORP.

LANCASTER, OHIO

DIAMOND SPECIALTY LIMITED
WINDSOR, ONTARIO

4817

23
of the 25
CENTRAL STATIONS
with the
LOWEST HEAT RATES*
use
DIAMOND BLOWERS

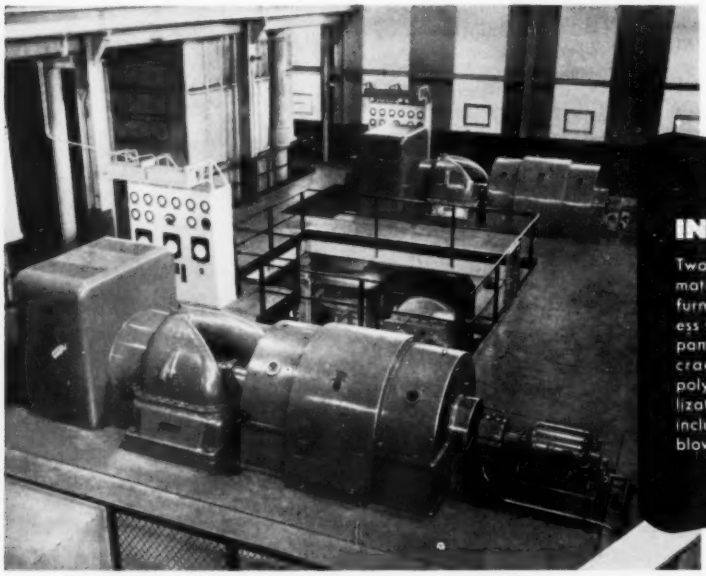
**From FPC report entitled "Steam-Electric Plant Construction Cost and Annual Production Expenses for 1950"*

STATION	UTILITY COMPANY	HEAT RATE* btu/kwhr
◆ Philip Sporn	Ohio Power Company	9,378
◆ Schiller	Public Serv. Co. of N. H.	9,672
◆ Sewaren	Public Service Elec. & Gas Co.	10,389
◆ Pt. Washington	Wisconsin Electric Power Co.	10,405
◆ Dan River	Duke Power Company	10,621
◆ Hutchings	Dayton Power & Light Co.	10,708
Russell	Rochester Gas & Elec. Co.	10,941
◆ Potomac River	Potomac Electric Power Co.	10,949
◆ Oswego	Niagara Mohawk Power Corp.	10,979
◆ Lumberton	Carolina Power & Light Co.	11,093
Pt. Jefferson	Long Island Lighting Co.	11,110
◆ Manchester St.	Narragansett Elec. Co.	11,173
◆ Tidd	Ohio Power Co.	11,190
◆ Watts Bar	Tennessee Valley Authority	11,215
◆ Lake Catherine	Arkansas Power & Light Co.	11,283
◆ White River	Indianapolis Power & Light Co.	11,292
◆ B. C. Cobb	Consumers Power Co.	11,302
◆ Bryce E. Morrow	Consumers Power Co.	11,329
◆ John C. Weadock	Consumers Power Co.	11,344
◆ Willow Island	Monongahela Power Co.	11,365
◆ W. Springfield	Western Massachusetts Elec. Co.	11,366
◆ Gilbert	New Jersey Power & Light Co.	11,416
◆ Cliffside	Duke Power Co.	11,431
◆ New Castle	Pennsylvania Power Co.	11,505
◆ Meredosia	Central Illinois Public Serv. Co.	11,530

◆ STATIONS HAVING DIAMOND BLOWERS

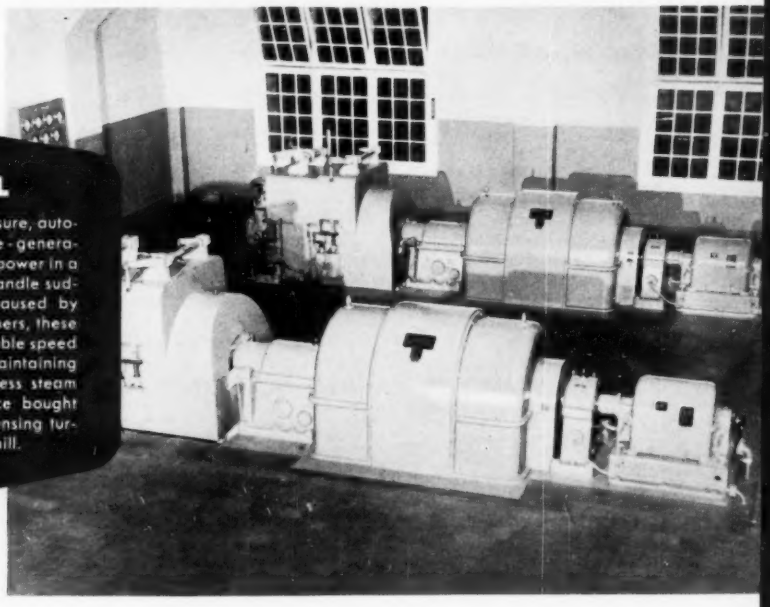
LOW HEAT RATES DEMAND CLEAN BOILERS ... AS WELL AS ADVANCED STATION DESIGN

"Meeting Industry's



IN AN OIL REFINERY

Two Elliott 4000-kw condensing, automatic-extraction turbine-generator units furnish the power and much of the process steam required by a tremendous expansion program involving a big cat cracker and new crude, distillation, polymerization, gas recovery and stabilization units. Other Elliott equipment included in the project: turbine-driven blowers, condensers, etc.

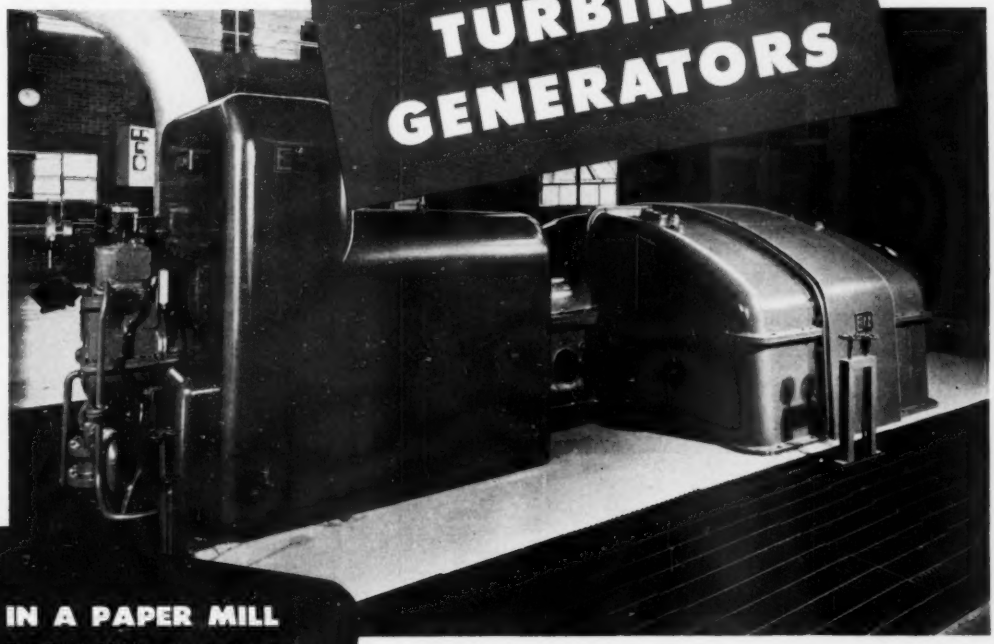


IN A PULP MILL

Two Elliott 2000-kw back pressure, automatic-extraction type turbine-generators were installed to provide power in a modernization program. To handle sudden electrical peak loads caused by modern log barkers and chippers, these turbines have sensitive and stable speed control, at the same time maintaining pressure control for the process steam load. This company has since bought two Elliott 3500-kw noncondensing turbine-generators for another mill.

varying power needs"

ELLIOTT TURBINE-GENERATORS



IN A PAPER MILL

This Elliott 2000-kw back-pressure turbine-generator is the first step in a new power generating program. It now runs in parallel with outside power, which maintains frequency and takes the electrical load swings. Future expansion calls for a duplicate generator driven by a condensing, extraction-type turbine, giving a flexible power and process steam combination in the power plant.

Producing economical power, as a by-product of process steam is the job of a properly applied turbine-generator in an industrial power plant. Elliott engineers will help you work out a type or combination of generating units which will fit the electrical and steam needs of your plant. You'll be proud of your Elliott turbine-generator's operating record.

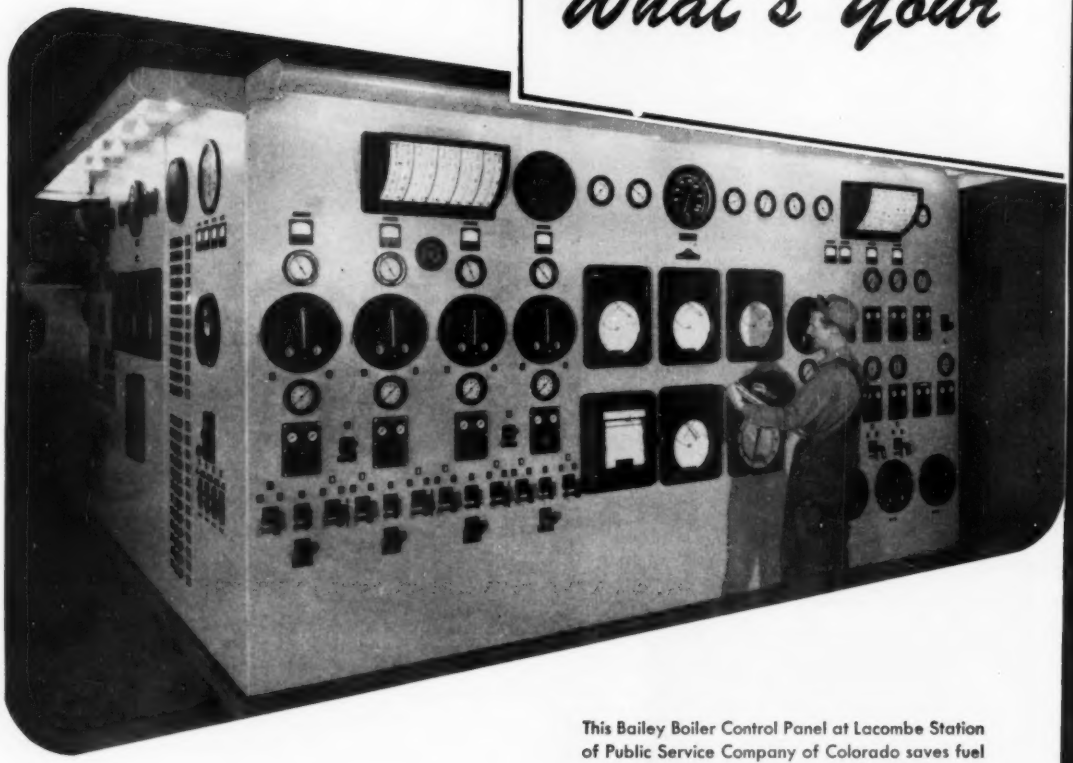
ELLIOTT Company

Steam Turbine Dept.
JEANNETTE, PA.

Plants at: JEANNETTE, PA. • RIDGWAY, PA.
AMPERE, N. J. • SPRINGFIELD, O. • NEWARK, N. J.
DISTRICT OFFICES IN PRINCIPAL CITIES

H2-5

What's Your



This Bailey Boiler Control Panel at Lacombe Station of Public Service Company of Colorado saves fuel and insures safe operation of a 350,000 lb per hr 850 psi, 900 F boiler fired by pulverized Colorado Lignite Coal and/or natural gas.

Controls for Steam Plants

COMBUSTION • PRESSURE
FEED WATER • LIQUID LEVEL
TEMPERATURE • FEED PUMPS

Control-Dollar Efficiency ?

Control-dollars frequently bring annual investment returns of 100% or more. When you buy adequate, well-applied steam plant controls, you increase your dollars' ability to work usefully for you.

That's where Bailey can help: Bailey Controls can give you a better control-dollar efficiency. Here's why:

1. Complete Range of Equipment—fully co-ordinated. You need never worry that a Bailey Engineer's recommendation is slanted in favor of a particular type of equipment, just because he has a limited line to sell—or that Bailey will pass the buck for efficient control; we offer *complete* boiler control systems.

2. Engineering Service—backed by experience. No other manufacturer of instruments and controls can offer as broad an experience, based on successful installations involving all types of combustion, flow measurement, and automatic control.

3. Direct Sales-Service—conveniently located near you. Bailey Meter Company's sales-service engineers are located in more industrial centers than those of any other manufacturer of boiler control systems; you get prompt, experienced service with a minimum of travel time and expense.

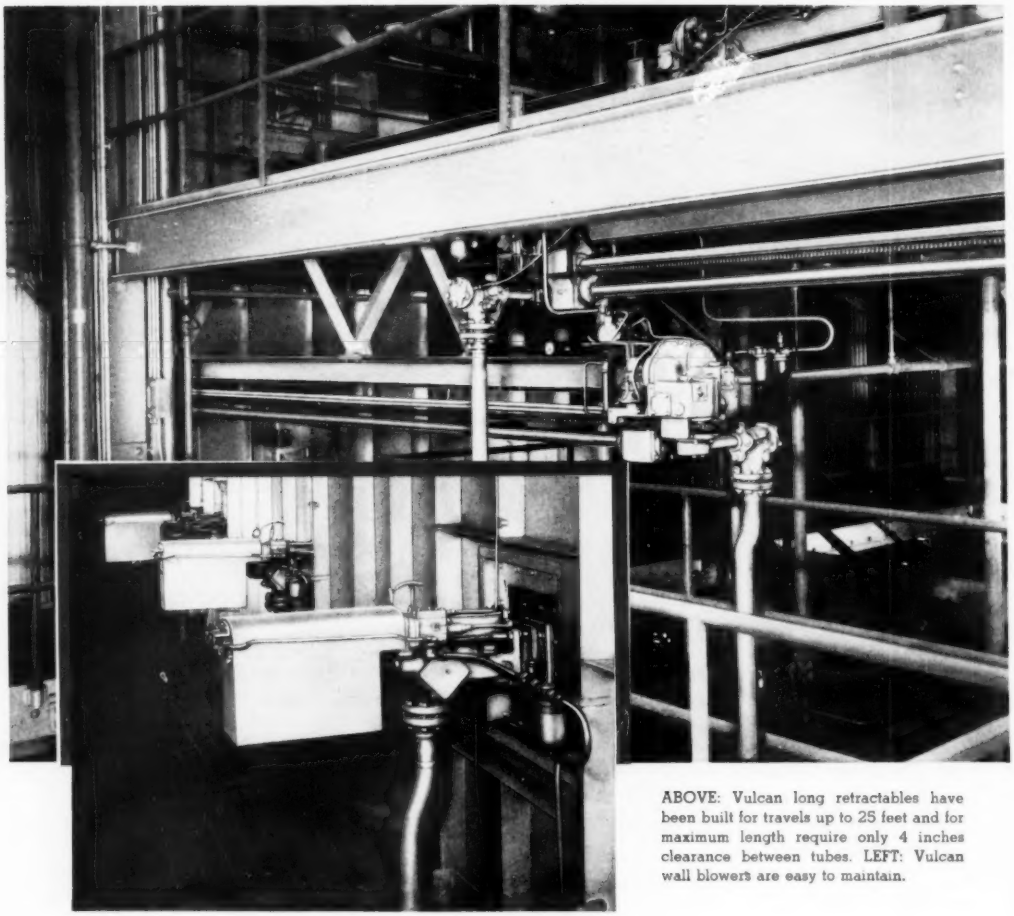
For better control-dollar efficiency—for more power per fuel dollar, less outage, and safer working conditions, you owe it to yourself to investigate Bailey Controls. Ask a Bailey Engineer to arrange a visit to a nearby Bailey installation. We're proud to stand on our record: "More power to you!"

A-112-2

BAILEY METER COMPANY

1036 IVANHOE ROAD • CLEVELAND 10, OHIO
BAILEY METER COMPANY LIMITED • MONTREAL, CANADA

At THE DETROIT



ABOVE: Vulcan long retractables have been built for travels up to 25 feet and for maximum length require only 4 inches clearance between tubes. LEFT: Vulcan wall blowers are easy to maintain.

VULCAN *Automatic*

EDISON COMPANY

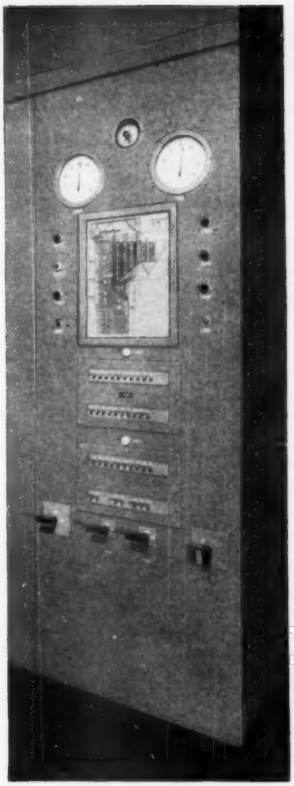
CONNERS CREEK BOILERS
16 and 18 Automatically Cleaned by VULCAN

At Conners Creek Power Plant, Boilers 16 and 18 are Babcock & Wilcox Radiant Type. Each is rated at 660,000 pounds of 1500-psig, 950-FTT steam per hour. Firing is with pulverized coal.

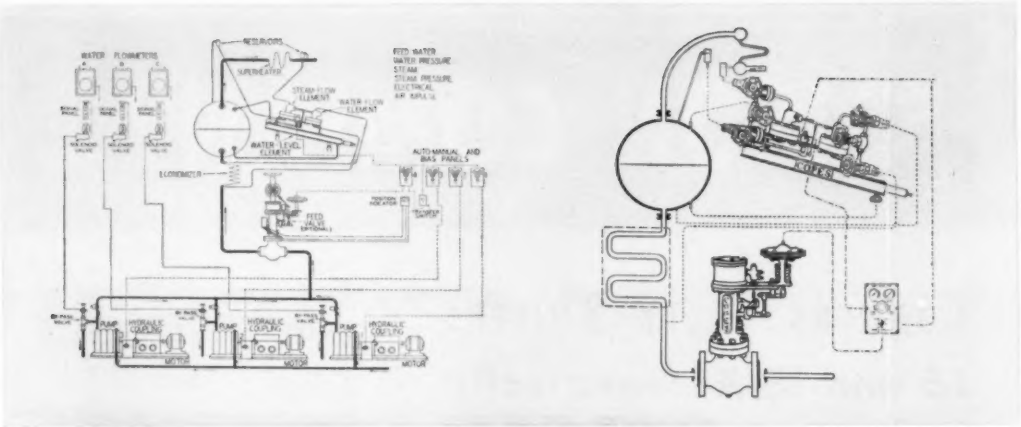
Boiler cleaning is by Vulcan. Each unit has twenty wall blowers, twelve long retractables in the boiler and superheater sections, eight rotaries in the economizer, and two controls for special air-heater cleaners. All are air-powered and blow with air. All are under fully automatic-sequential control from a central panel.

Whether your boilers are large or small—utility or industrial—power or process—depend on Vulcan for effective cleaning at low overall cost. Write for Bulletin 483 on Vulcan Automatic Soot Blowing.

VULCAN SOOT BLOWER DIVISION
Continental Foundry & Machine Company
DU BOIS, PENNSYLVANIA

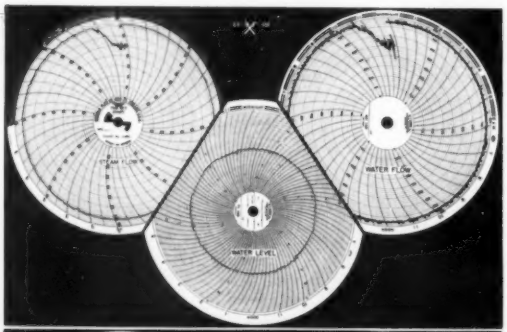


Standing at this panel, the operator can check each step of the cleaning cycle, whether on automatic or selective sequence, or on manual control.



COPES System A—COPES Balanced Flow (three-influence) Control applied to the hydraulic couplings of the three pumps feeding this boiler. Minimum Flow Control System is also shown.

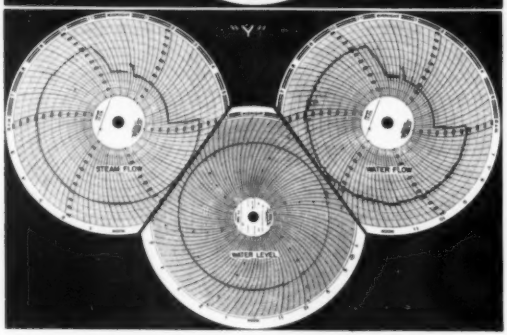
COPES System B—COPES Balanced Flow Regulator feeds the boiler according to the balanced influences of boiler water level, rate of steam flow and rate of feed water flow.

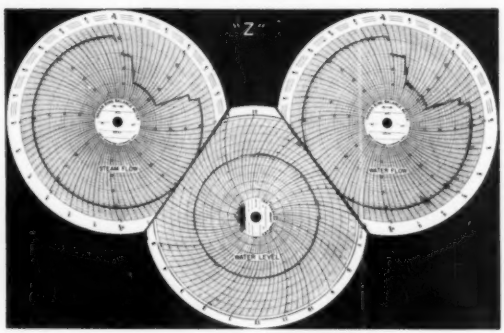


CHARTS "X"—Steam-flow, water-flow and water-level charts for a C-E-S steam generator with peak load capacity of 750,000 pounds per hour, with COPES feeding.

CHARTS "Y"—Steam-flow, water-flow and water-level charts with COPES feed control on a Babcock & Wilcox radiant type boiler. Peak load: 425,000 pounds per hour.

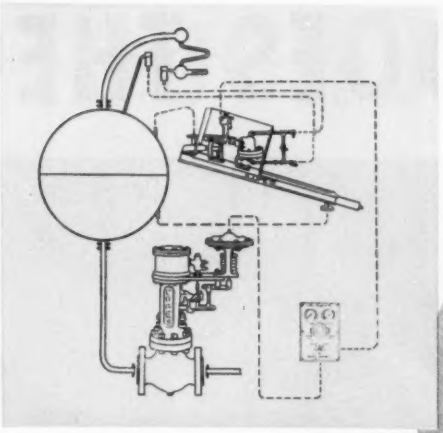
CHARTS "Z"—Steam-flow, water-flow and water-level charts for a C-E-S radiant-type boiler having maximum evaporation of 1,150,000 pounds of steam per hour.





COPES

BOILER FEED



COPES System C—COPES Flowmatic Regulator, air-operated, is the most modern design of the original two-element control. It is actuated by boiler water level and rate of steam flow.

WHICH CONTROL SYSTEM PRODUCED WHICH CHARTS?

Shown schematically are three different COPES Boiler Feed Control Systems—each used in a different plant of a large utility. Results obtained with each system are shown by one of the sets of charts. But could you match each set of charts with the control that produced it?

You'll find little difference in the gearing of feed flow to steam output—or in the stabilization of water level. The point is that COPES designs each feed control system to the individual boiler design and operating conditions. This alone determines the number of control influences—one, two or three.

Try matching Charts "X," "Y" and "Z" to the corresponding control systems—then mail the coupon. The first twenty-five who do so will receive a useful gift.

NORTHERN EQUIPMENT DIVISION
CONTINENTAL FOUNDRY & MACHINE COMPANY
ERIE, PENNSYLVANIA

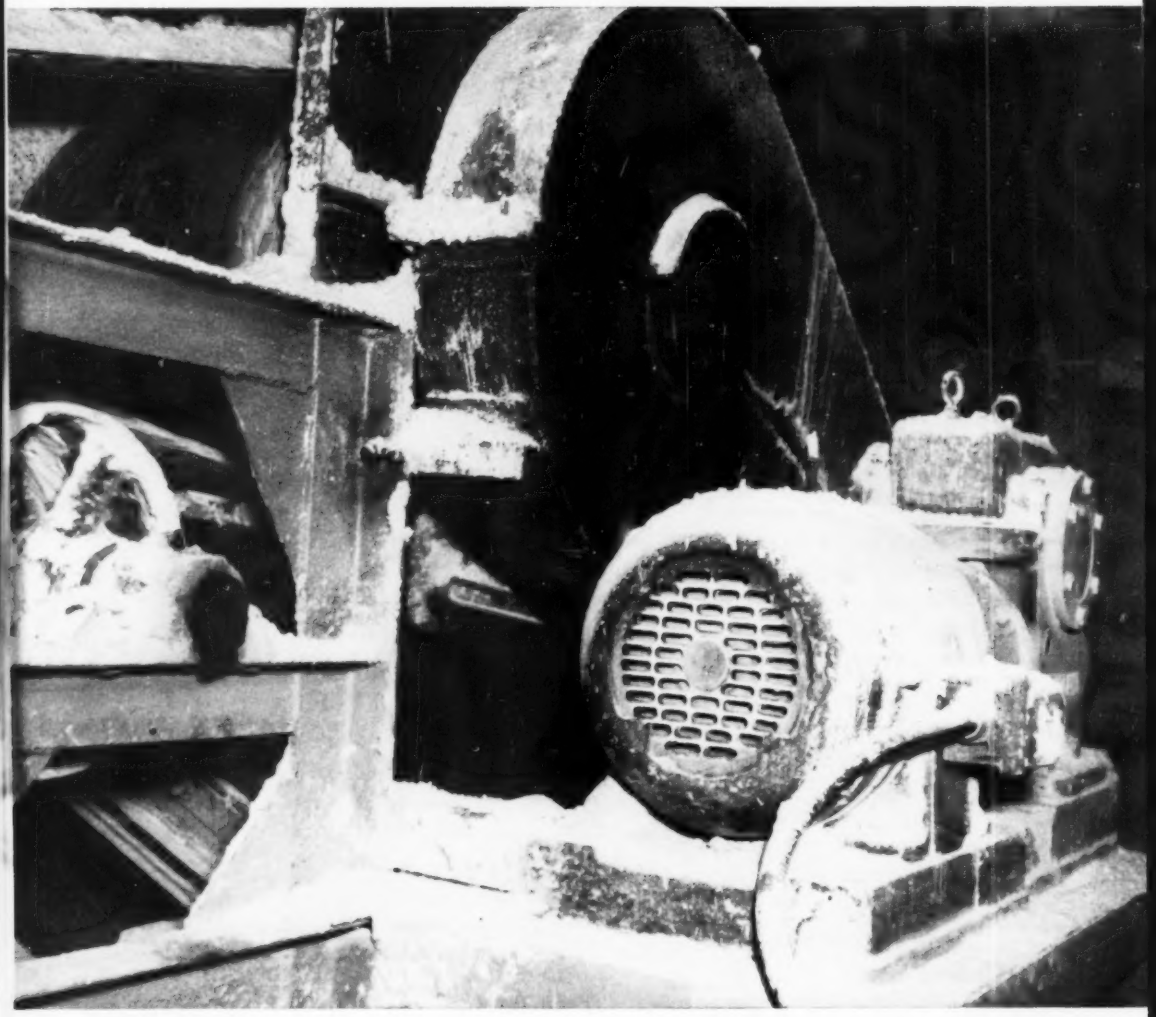
Here's how I'd match the charts and control systems:

Charts "X" were from the boiler with Control System ☐
Charts "Y" were from the boiler with Control System ☐
Charts "Z" were from the boiler with Control System ☐

NAME _____
POSITION _____
COMPANY _____
ADDRESS _____
CITY _____ STATE _____

WATER REGULATION

INDUSTRY DOES THE



THE CHEMICAL INDUSTRY depends on standard, "off the shelf," Tri-Clad motors in the most adverse operating conditions, including corrosive, abrasive and explosive atmospheres. The 7½-hp totally-enclosed fan-cooled Tri-Clad motor above drives a crude ash conveyor an average of over 23 hours every day.

GENERAL ELECTRIC

752-12

TOUGH JOBS WITH TRI-CLAD MOTORS

REG. U.S. PAT. OFF.

EXTRA PROTECTION

Every Tri-Clad motor, open or totally-enclosed, is triply-protected against *physical damage, electrical breakdown* and *operating wear and tear.*

That's why you'll find general-purpose Tri-Clad motors in every industry—not only on the usual jobs which they do so economically—but on the *tough* jobs where unfailing performance is a must.

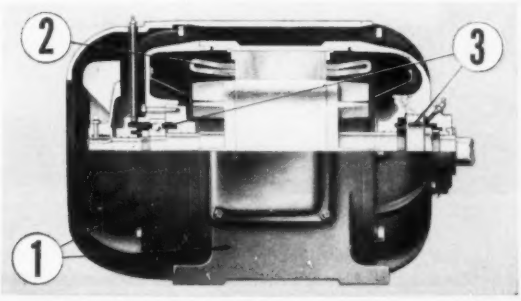
PROMPT DELIVERY

Today especially, delivery and service are important. G-E shipping points all over the country are ready to deliver most standard ratings right out of stock. And with the most complete service shop network in the motor industry you are assured of the best attention to motor problems.

TIMELY INFORMATION AVAILABLE

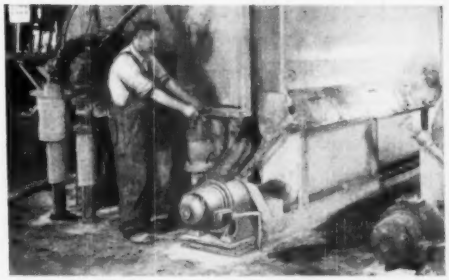
If you are concerned with training manpower, the new G-E Motor Selection and Application Course, including nine strip films, is a unique and valuable aid. A sample copy of the "Instructor's Manual" (GEZ-310), which outlines the course, may be obtained on request.

Also available is a free bulletin on "How to Maintain Motors and Generators" (GET-1202). Contact your local G-E sales office for any of the above material, or write *Section 752-12, General Electric Co., Schenectady 5, N. Y.*

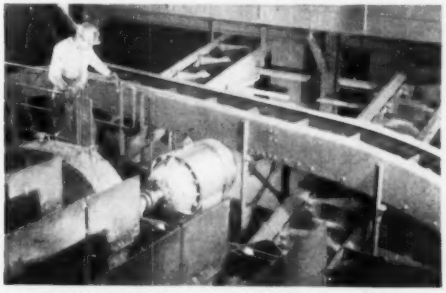


UNINTERRUPTED SERVICE under tough conditions is assured by many outstanding features of Tri-Clad totally-enclosed motors, for example: **1** rigid, cast-iron end shields and frame; **2** Formex* windings which resist oil, heat, shock, moisture, abrasion; **3** *completely* enclosed bearings that will last longer because provision is made for relubrication if necessary.

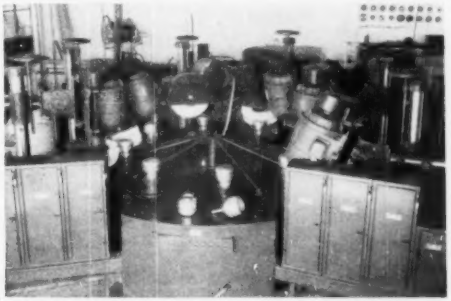
Reg. trademark of General Electric Co.



FOOD PLANTS on "continuous process" operation depend on Tri-Clad motors to avoid costly shut-downs. Totally-enclosed, non-ventilated Tri-Clad gear-motor above drives a repulper in a sugar refinery.



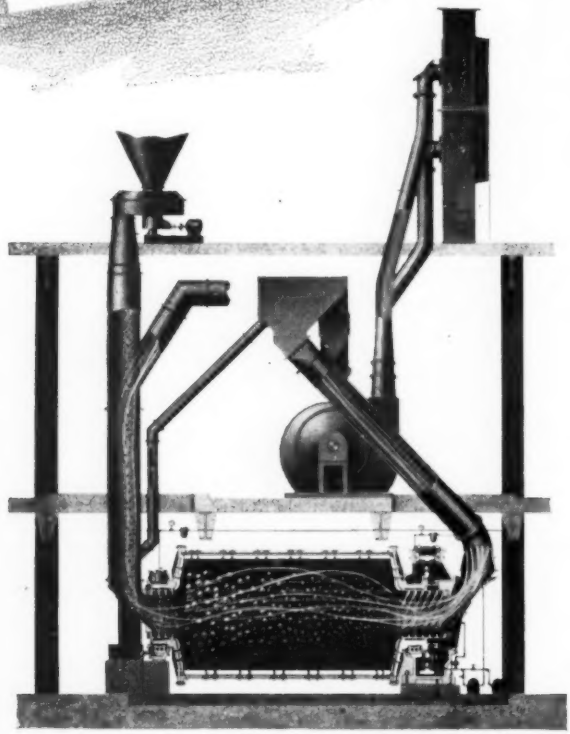
MINING INDUSTRIES know Tri-Clad motors can take abuse, don't twist out of line and are corrosion-resistant. This totally-enclosed, fan-cooled, Tri-Clad motor runs a coal conveyor.



METAL WORKING FIELD likes Tri-Clad motors because they're easy to mount in any position, rigid and smooth running, and *can be relubricated if operating conditions warrant — without disassembly!* Six 7½-hp TEFC Tri-Clad motors run machine above which polishes 500 to 1000 metal coffee-makers per hour!

UTMOST ECONOMY *and* SCARCITY *of* FUEL

prompted choice of 26 KVS



Contracts recently placed with John Thompson, Ltd. by the British Electrical Authority (B.E.A.) include 26 KVS Air Swept Tube Mills which will pulverize coal for the generation of 5,750,000 lbs. of steam per hour in John Thompson boilers. The following plants and equipment are involved:

Tilbury Power Station, London . . .
five units, each designed for 550,000 lbs. per hr. at 950 lbs. per sq. in. and 925° F.

Marchwood Power Station, London . . .
four units, each designed for 550,000 lbs. per hr. at 950 lbs. per sq. in. and 925° F.

Brimsdown Power Station, London . . .
two units, each designed for 340,000 lbs. per hr. at 950 lbs. per sq. in. and 925° F.

Pulrose Power Station, Isle-of-Man . . .
two units, each designed for 60,000 lbs. per hr. at 425 lbs. per sq. in and 775° F.

AIR SWEPT TUBE MILLS

for 4 Central Power Stations

KVS equipment was selected because economy was of prime importance and because coal was scarce and of low grade. Confidence in the ability of Kennedy Van Saun Air Swept Tube Mills to meet these rigid requirements was a determining factor in this selection.

Outstanding among the many reasons why KVS equipment is preferred in modern power plants are:

. . . unburnt carbon losses are less than half of one percent at all ratings.

. . . load changes do not affect high efficiency.

. . . up to 20% moisture evaporated in the mill.

. . . grinding balls added without shutting down.

. . . continuous, year-to-year operation; availability better than 99%.

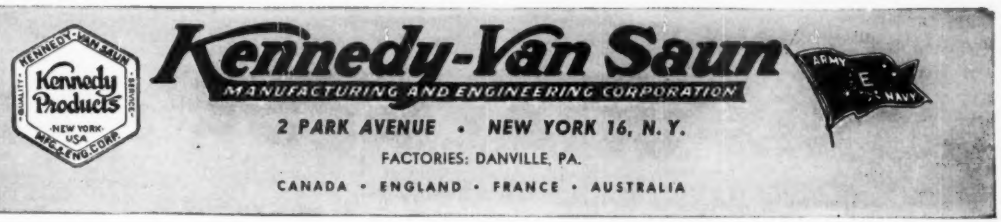
. . . low maintenance costs remain low, year after year.

. . . instant response to combustion controls.

. . . use the lowest pri[ce] obtainable and [get] for your dollar.

. . . [no] [re]duced. Temp[er] [qu]ality helps [sa]ve coal.

We Know the Answer to Your Fuel Problem.



First with Super-

ALLIS-CHALMERS INSTALLS STEAM TURBINE GENERATOR UNIT WITH SUPERCHARGED HYDROGEN COOLING

SUPERCHARGED HYDROGEN COOLING—the greatest advance yet made in turbine-generator design—is here *now*. This 60,000 kw unit is installed and running at the Edgewater station, Sheboygan, of the Wisconsin Power & Light Company.

Allis-Chalmers is first to develop and apply the principle of directly cooling the conductors with high velocity gas. This unit is the pioneer of a new design trend. Following operating experience, the utility ordered two more similar units, with reheat, for its new Rock River station.

As compared to the 35 percent output gain hydrogen cooling gives over air cooling, supercharged hydrogen cooling increases generator ratings *70 percent* over ordinary hydrogen cooling. Significant gains are made in increasing light load efficiencies and decreasing foundation and building requirements!

The Edgewater turbine has these outstanding features:

Hydraulic control and operation with accessible placement of main stop valve; centralized grouping of operating controls; shaft-driven centrifugal pump simplifying location of oil tank; cam-operated inlet valves accessibly located on top of cylinder, and exclusive A-C method of temperature compensation for horizontal *and* vertical thermal movement.

All oil piping is above the floor, simplifying foundation and installation. And, as throughout the complete Allis-Chalmers line — ranging from the smallest single cylinder machines to single shaft, tandem compound, condensing units of 150,000 kw — labyrinth steam seals are used. The steam sealed gland system is self-contained and provides operational safety with minimum attention.

You get the real design advances *first* from Allis-Chalmers. When planning the installation or expansion of a steam-electric power plant, let A-C simplify your problem. This *one* source will provide you with the world's widest range of power plant equipment. Bulletin 03B6801A on standardized steam turbine units and other literature on all products listed are available. For your copies, call your nearest A-C office or write to Allis-Chalmers, Milwaukee 1, Wis.

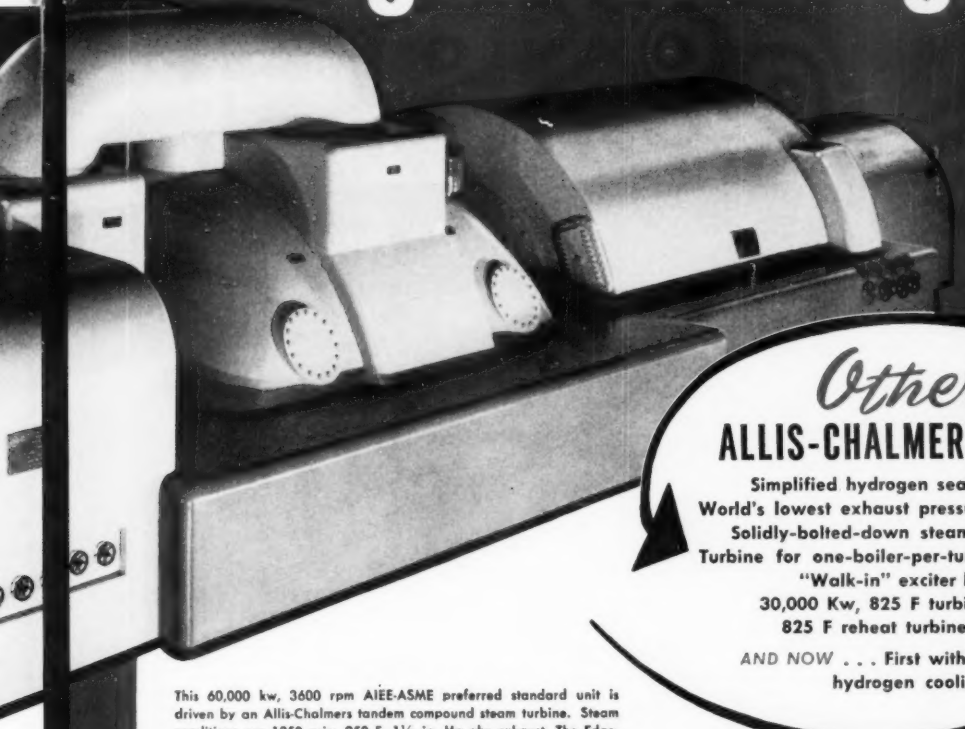
A-3645

ALLIS-CHALMERS

World's Widest Range of Power Plant Equipment

TURBINES & GENERATORS | CONDENSERS & PUMPS | SWITCHGEAR & BREAKERS | MOTORS & CONTROL | TRANS-FORMERS | WATER CONDITIONING

Charged Cooling!

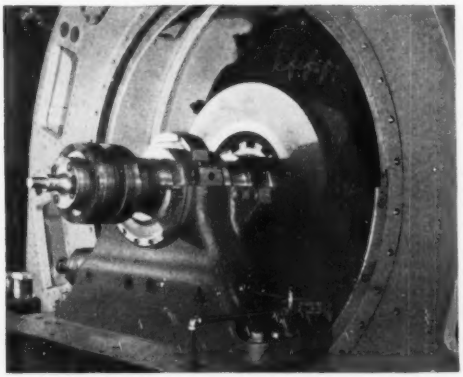


Other
ALLIS-CHALMERS FIRSTS

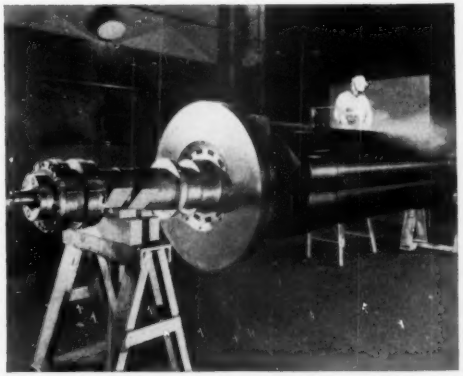
Simplified hydrogen seal and control
World's lowest exhaust pressure steam turbines
Solidly-bolted-down steam end pedestal
Turbine for one-boiler-per-turbine arrangement
"Walk-in" exciter housing
30,000 Kw, 825 F turbine, in 1931
825 F reheat turbine, in 1935

AND NOW . . . **First with supercharged hydrogen cooling!**

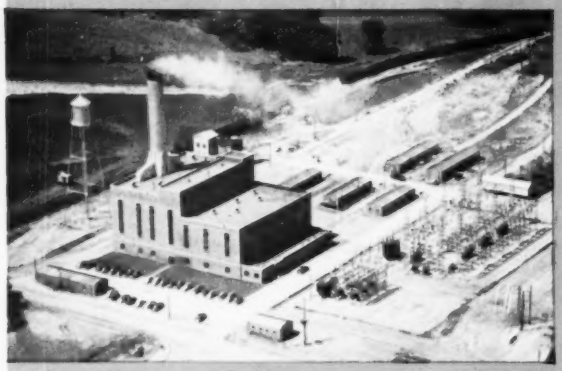
This 60,000 kw, 3600 rpm AIEE-ASME preferred standard unit is driven by an Allis-Chalmers tandem compound steam turbine. Steam conditions are 1250 psig, 950 F, 1½ in. Hg abs exhaust. The Edgewater station consists of this and two Allis-Chalmers 30,000 kw units.



Twenty years of Allis-Chalmers blower experience aided in the design of the new rotor ventilating system. The two stage centrifugal compressor at the exciter end of the rotor "supercharges" the hydrogen to several times the pressure obtained from the usual cooling fans. Its output is cooled separately and directed into the rotor from both ends.



Shop view of rotor during construction. Instead of being sent to vent ducts in the rotor teeth, the hydrogen is directed *through* the rotor conductors. The gas is in intimate contact with the copper right where the heat originates. This improved ventilation permits a reduction in unit length and consequent reduced building space requirements.

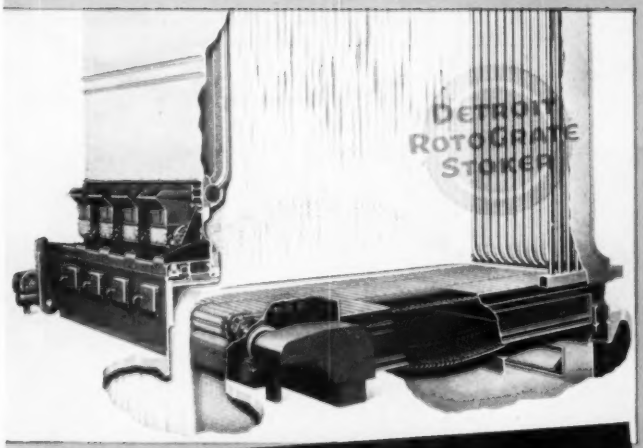


PRAIRIE CREEK POWER STATION
Operated by Iowa Electric Light & Power Co., Cedar Rapids, Iowa

PUBLIC

Who have to get

BUY DETROIT



DETROIT STOKER COMPANY
GENERAL MOTORS BLDG., DETROIT 2, MICH.
Works at Monroe, Mich. • District Offices in Principal Cities

Selling prices of electric power usually are fixed, but producing costs are continually increasing.

Therefore, public utilities must be absolutely sure of getting the biggest possible dollar value out of everything they buy, to hold down their costs.

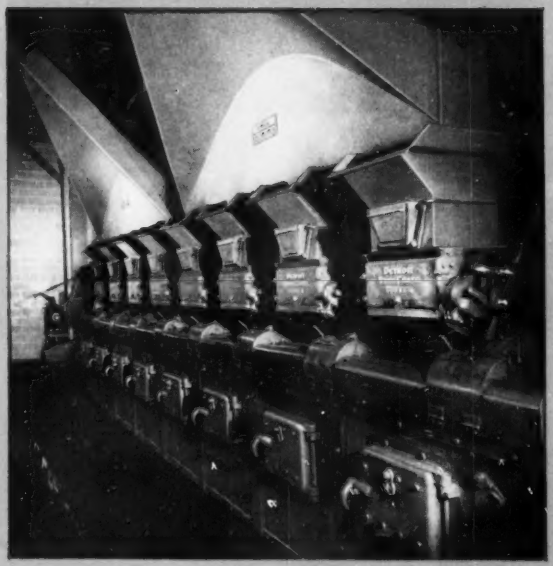
Their preference for Detroit RotoGrate Stokers is based on the RotoGrate's proven ability to provide exceptional fuel economy with very little maintenance over a very long life . . . to burn readily any kind of Bituminous coal or Lignite.

Detroit RotoGrate, the most advanced spreader stoker, with grates that move slowly forward to continuously discharge ash at the front provides effective furnace turbulence and a scientifically designed, rugged reinjection system. • Write for Bulletin.

UTILITIES

the biggest dollar value

STOKERS



Detroit RotoGrate Stoker on the line in Prairie Creek Station

REPRESENTATIVE INSTALLATIONS OF DETROIT STOKERS IN PUBLIC UTILITIES

Central States Electric Company
Iowa Falls, Iowa

* **Southern Utah Power Co.**
Cedar City, Utah

Northern States Power Company
LaCrosse, Wisconsin

* **Northern States Power Company**
Mankato, Minn.

Northern States Power Company
Red Wing, Minnesota

* **Central Illinois Electric & Gas Company**
Sabrooke Station: Rockford, Illinois

Ohio Public Service Company
Mahoningside Plant: Warren, Ohio

* **Northern States Power Company**
Sioux Falls, South Dakota

Montana-Dakota Utilities Company
Kincaid, North Dakota

Iowa Public Service Company
Eagle Grove, Iowa

* **Sioux City Gas & Electric Company**
Sioux City, Iowa

Iowa Public Service Company
Storm Lake, Iowa

Central Iowa Power Cooperative
Cedar Rapids, Iowa

* **Indianapolis Power & Light Company**
Indianapolis, Indiana

Montana-Dakota Utilities Company
Beulah, North Dakota

Corn Belt Power Cooperative
Humboldt, Iowa

* **Black Hills Power & Light Company**
Osage, Wyoming

Minneapolis Street Railway Company
Minneapolis, Minnesota

Mississippi Valley Public Service
Winona, Minnesota

* **Iowa Public Service Company**
Waterloo, Iowa

Montana-Dakota Utilities
Mobridge, South Dakota

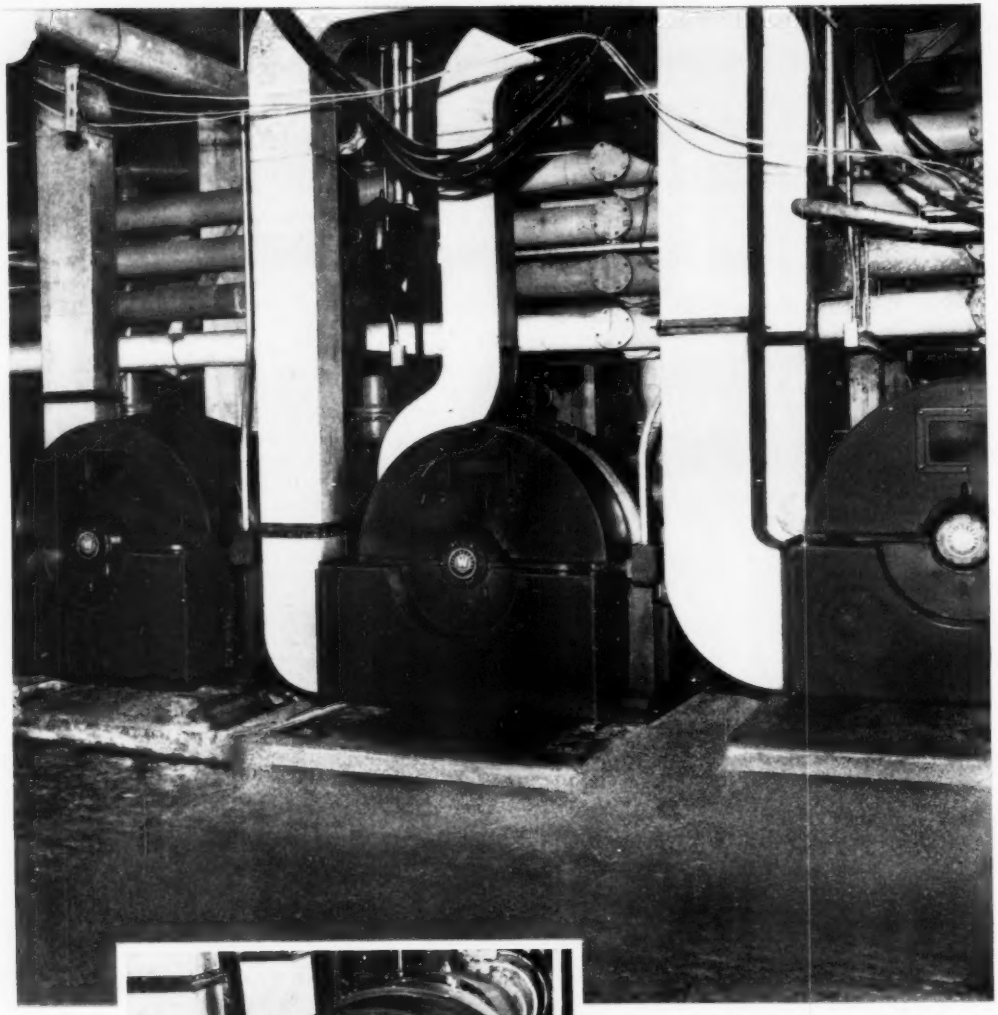
Montana-Dakota Utilities Co.
Sheridan, Wyoming

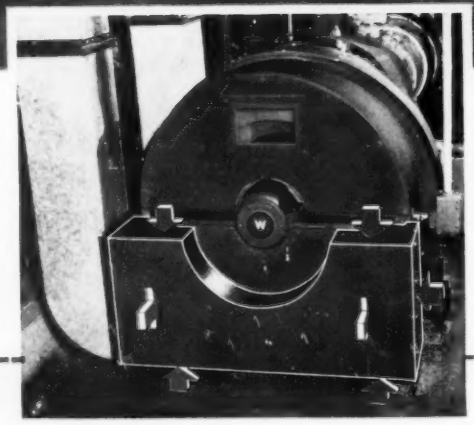
Prairie Creek Power Station
Operated by Iowa Electric Light & Power Co.

Iowa Southern Utilities Company
Bridgeport Station: Eddyville, Iowa

* **Central Illinois Electric & Gas Co.**
Fordham Station: Rockford, Illinois

* *Repeat orders.*





The above is a typical forced-ventilated installation. These same ducts could have been brought into these motors from any angle as shown by the arrows on the inset at the left.

WHERE FORCED VENTILATION IS REQUIRED . . .

Westinghouse Air Inlet Brackets Offer Complete Flexibility of Installation

From the top, bottom, front or either side . . . ventilating ducts or pipes may be brought in from practically any angle to this forced-ventilated, large induction motor. It's the ventilation system and design of the air inlet brackets that make this possible.

Ventilating air is supplied to the motor from both ends through the two air inlet brackets. These brackets can be supplied with duct or pipe connections located on any of the exposed surfaces. Thus, many installation problems are eliminated and the motor can be positioned without regard to the space available for duct work.

The ventilating air is discharged from both sides of the motor through louvered openings. If desired, these openings can also be housed so that the exhausted air can be routed away through similar ducts or pipes.

Other important Westinghouse features that you will want to consider in selecting your next large induction motor are:

Bearing construction and end enclosures make bearing inspection, cleaning, servicing and replacement as easy as on a standard open motor.

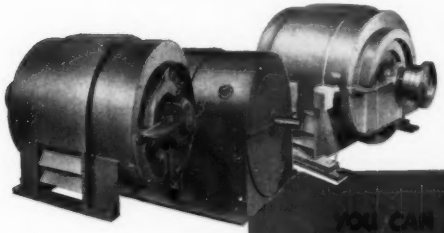
Welded steel construction to form a sturdy frame.

Insulation of great dielectric strength and high heat resistance for long life.

All-metal rotors are dynamically balanced for quiet, smooth operation.

Ask your Westinghouse representative about all the details of this improved large motor or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania.

J-10356



Also available are these three types of large induction motors. Open dripproof motors for general service. Outdoor motors for service in the open weather. Splashproof motors for protection against falling liquids or solid particles.

YOU CAN BE SURE . . IF IT'S Westinghouse

LARGE INDUCTION MOTORS

Meeting a tight

New York's largest

STEAM GENERATOR

a 1,450,000 lb per hr FOSTER WHEELER

New York is perennially "bursting at the seams"—but there is always a way to accommodate additional development. This is made possible by wise city planning and the far-sighted policy of the Consolidated Edison Company of New York, Inc. which keeps ahead of New York's ever-growing demand for electricity. The new Foster Wheeler Steam Generator now being constructed for the East River Station of the Consolidated Edison Company is a contemporary example of how one organization seeks to anticipate the needs of future populations.

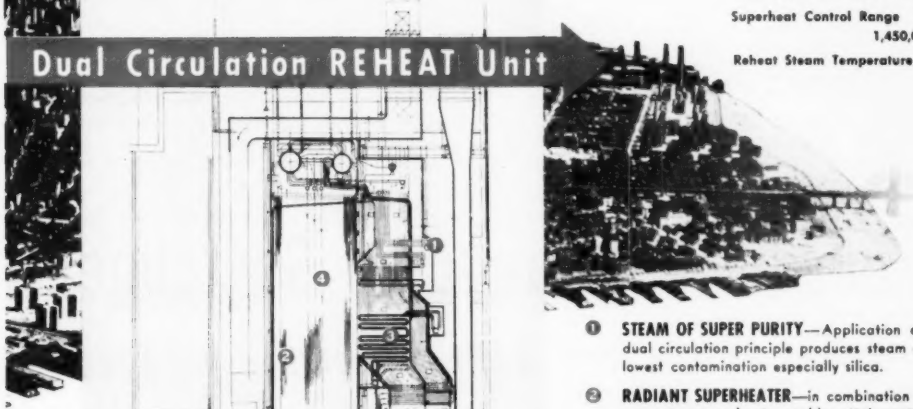
FOSTER WHEELER CORPORATION • 165

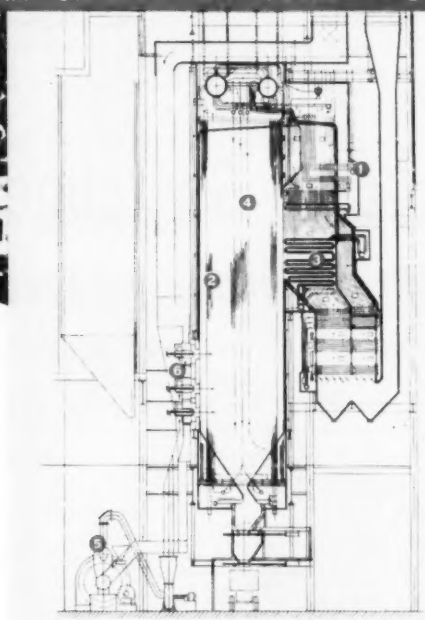
situation

New FW Steam Generator for the East River Station of the Consolidated Edison Company of New York, Inc.

Maximum Capability	1,450,000 lb per hr
Pressure Superheater Outlet	1850 psig
Primary Steam Temperature	1000 F
Superheat Control Range	325,000 to 1,450,000 lb per hr
Reheat Steam Temperature	1000 F

Dual Circulation REHEAT Unit



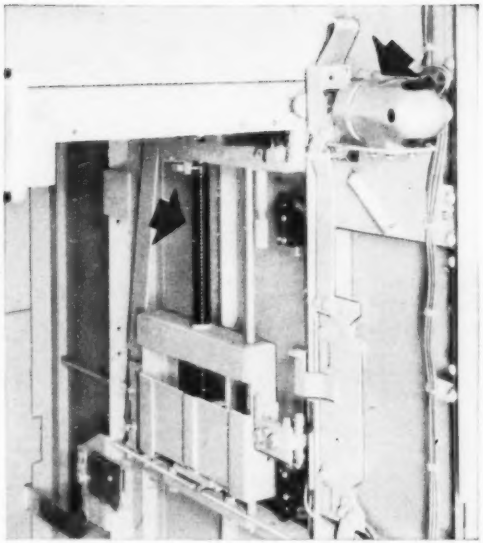


1. **STEAM OF SUPER PURITY**—Application of dual circulation principle produces steam of lowest contamination especially silica.
2. **RADIANT SUPERHEATER**—in combination with convection superheater enables attainment of full primary steam temperature from 25% to full load.
3. **CONVECTION REHEATER**—Location in low temperature zone after convection superheater provides protection against all variables in operation.
4. **CONSERVATIVE FURNACE**—Low heat absorption rates per unit area and low furnace exit gas temperatures.
5. **FOSTER WHEELER BALL MILLS**—High availability, low maintenance and sustained fineness of pulverization.
6. **FOSTER WHEELER TURBULENT BURNERS**—Turbulent action of air and fuel produces uniform mixture for complete combustion and even heat distribution.

BROADWAY, NEW YORK 6, N. Y.

FOSTER WHEELER

REMOVABLE MAGNE-BLAST CIRCUIT BREAKER features improved flame-retardant insulation and simplified contact design. Breaker operating mechanism and control relay are on the front of breaker for easy accessibility.



NEW FASTER ACTING BREAKER ELEVATING MECHANISM can raise the removable circuit breaker into position, or lower it for testing, in 30 seconds. A new compact gear-motor drives the simplified jack screw elevating mechanism.

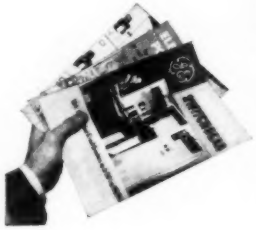
Improved G-E Metal-clad Switchgear

- - - - - - - STRONGER! SAFER! matched to today's demands for more dependable power for increased production

With fast-moving production schedules calling for more and more electric power, General Electric's improved Metal-clad Switchgear, in 4.16 kv and 13.8 kv ratings, answers the need for even greater power circuit protection and freedom from electrical shut-downs.

Retaining all the basic advantages pioneered in earlier G-E Metal-clad Switchgear and meeting all industry standards, this improved equipment offers a wealth of pace-setting design refinements. New features simplify operation and inspection and provide increased safety for personnel. And with stronger, more rigid construction and simplified design of many components, you get even more dependability.

Look over the typical improvements shown here. Then get the complete story from your local G-E Apparatus Sales Office, or write to General Electric Company, Schenectady 5, N. Y.

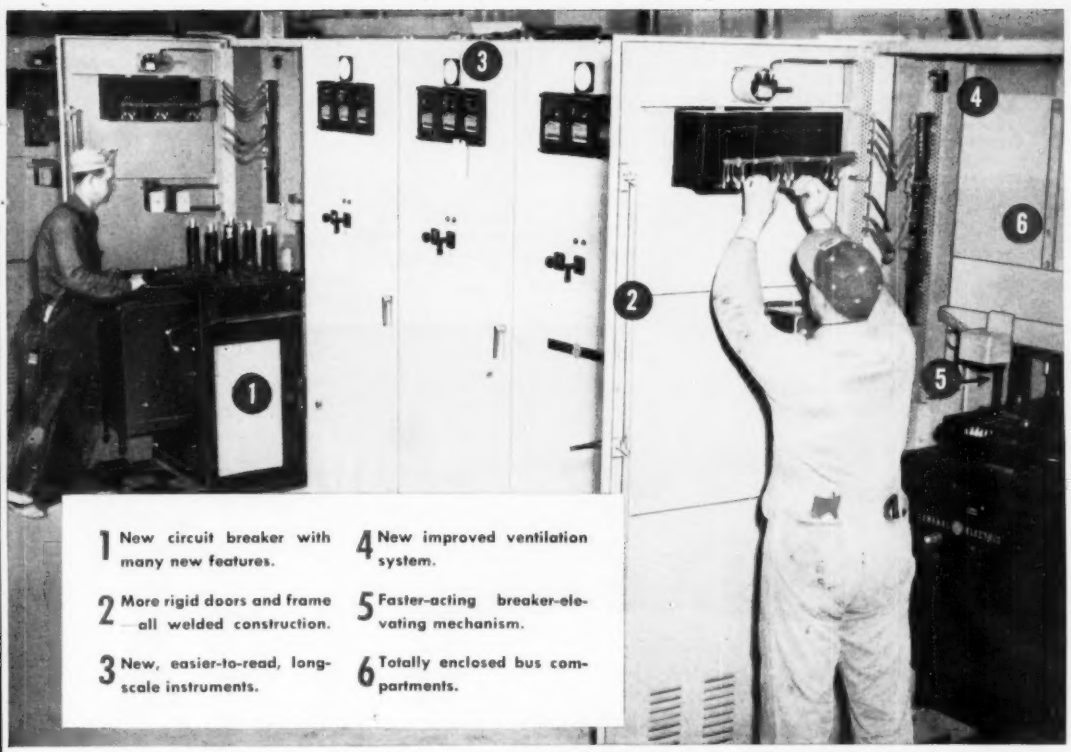


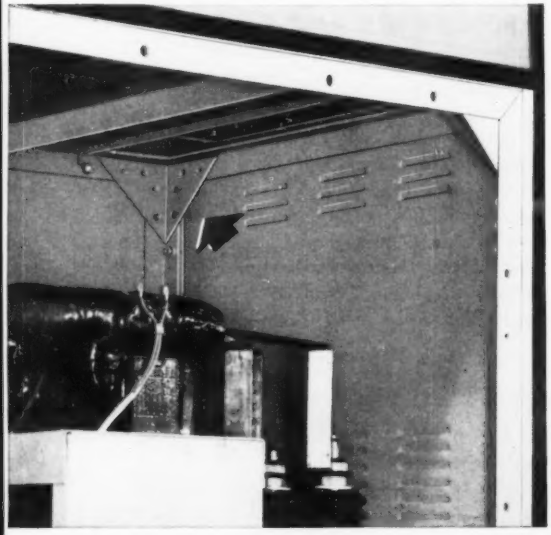
Complete data at your fingertips. Write for these helpful bulletins

Full information on modernizing or expanding your electrical system with G-E packaged equipment is given in these three illustrated booklets. Write for GEA-5664 "G-E Metal-clad Switchgear," GEA-3592 "Load-center Unit Substations," and GEA-5600 "Power for Industry's Third and Biggest Expansion."

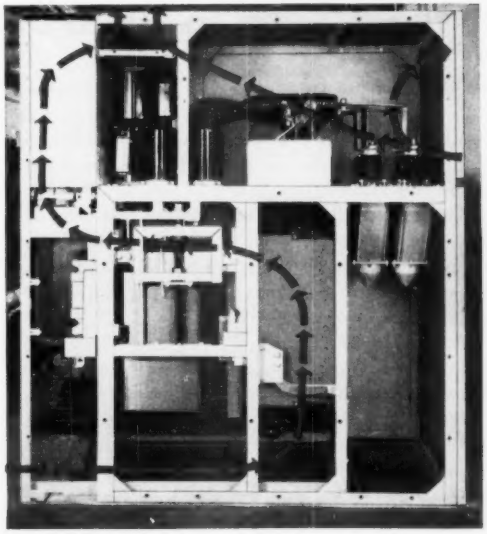
GENERAL ELECTRIC

154-6


1 New circuit breaker with many new features.
2 More rigid doors and frame — all welded construction.
3 New, easier-to-read, long-scale instruments.
4 New improved ventilation system.
5 Faster-acting breaker-elevating mechanism.
6 Totally enclosed bus compartments.

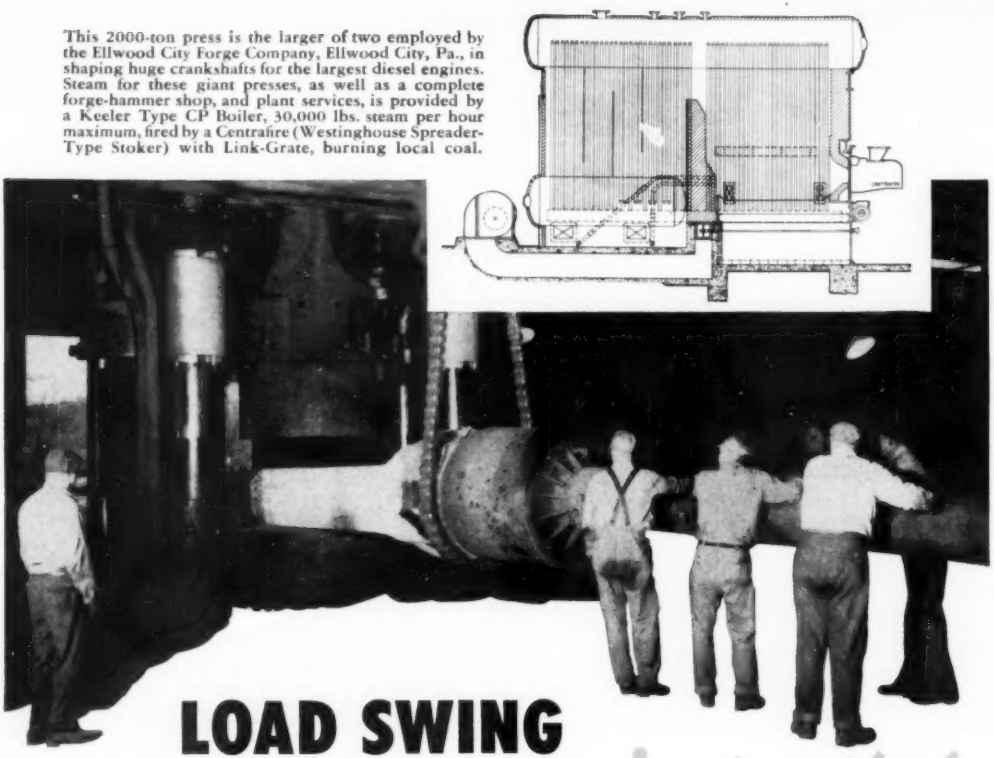


FRAME NOW COMPLETELY WELDED into one solid unit. Gusseted corners (see arrow) provide greater rigidity. Doors have a three-point latch operated from a single handle, and are reinforced against warping by a steel tube at hinge side.



IMPROVED VENTILATING SYSTEM: Arrows show natural draft of air that constantly ventilates entire switchgear unit. The totally enclosed bus compartment, at upper left, is cooled by circulation of air around it.

This 2000-ton press is the larger of two employed by the Ellwood City Forge Company, Ellwood City, Pa., in shaping huge crankshafts for the largest diesel engines. Steam for these giant presses, as well as a complete forge-hammer shop, and plant services, is provided by a Keeler Type CP Boiler, 30,000 lbs. steam per hour maximum, fired by a Centrafire (Westinghouse Spreader-Type Stoker) with Link-Grate, burning local coal.



LOAD SWING

from zero to 30,000 lbs. *instantly!*

As the giant presses and forge hammers at Ellwood City Forge Company are turned on and off, load upon the boiler . . . and the stoker . . . swings *instantly* from 10,000 to 30,000 lbs. . . . and back again, just as suddenly. In summer the swing is from zero to 30,000 lbs!

That's a grueling test of flexibility and dependability in the stoker, which must provide an instant inrush of heat to maintain pressure on the upswing . . . and must cut off cleanly to prevent boiler popping on the downswing.

Prior to installation of a Westinghouse Centrafire® with Link-Grate, the hammermen were starved for steam . . . were handicapped and slowed down in working the metal; costly reheats were often required. Boiler popping lost expensive steam to the atmosphere.

The Westinghouse Centrafire with Link-Grate, however, has ended these troubles. It follows the load . . . up or down . . . with a flexibility characteristic of the Centrafire. Moreover, with steam flow cut to zero for up to six hours between shift changes, the Centrafire holds the fire. And . . . there has been no forced shutdown of this unit since its installation.

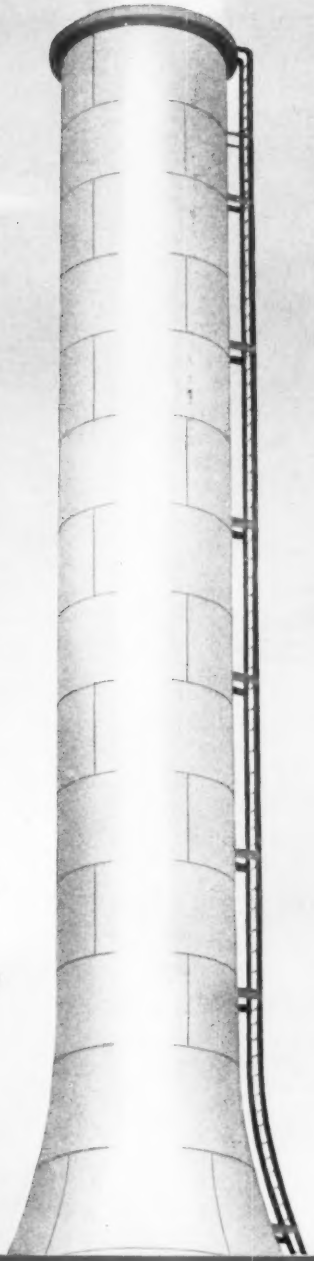
You can have the flexibility . . . the reliability . . . the low operating and maintenance costs of a Westinghouse Stoker with any boiler of your choice. A Westinghouse Stoker Application Engineer is as near to you as your telephone . . . or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Penna. J-50529

YOU CAN BE SURE . . . IF IT'S

Westinghouse

STOKERS

American Blower . . . a time-honored name in air handling



Look at the almost total absence of fly ash from this stack. This is due to an American Blower Fly Ash Precipitator. On a given application, as the load falls off and fly ash becomes harder to catch, this precipitator automatically maintains a higher efficiency than any other collector of mechanical type.

AMERICAN BLOWER

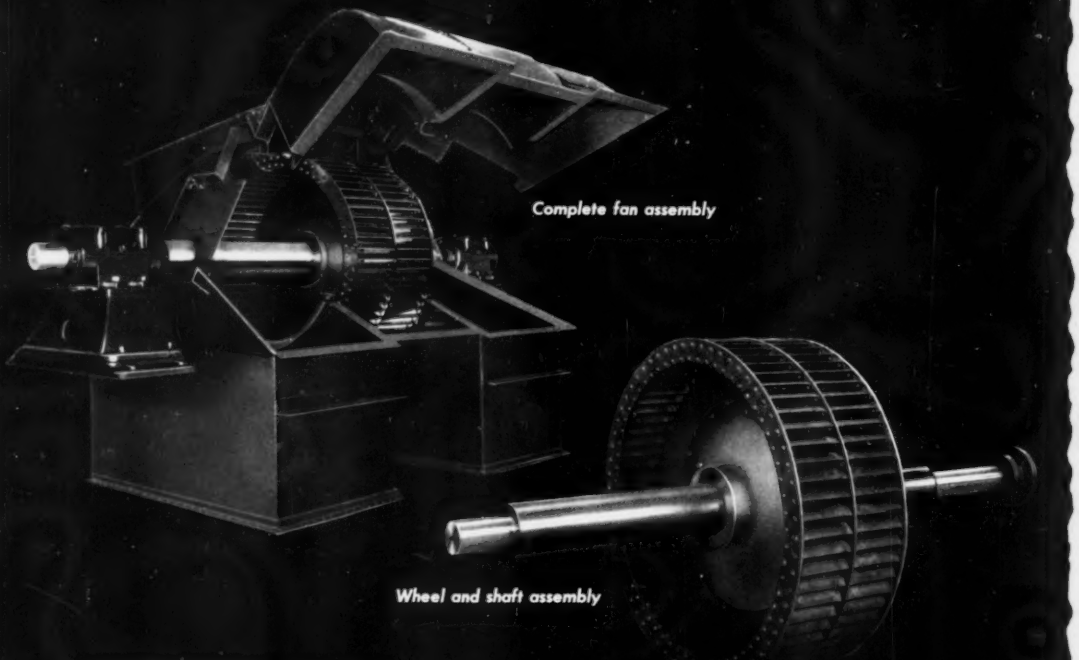
AMERICAN BLOWER CORPORATION, DETROIT 32, MICHIGAN
CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONTARIO

Division of American Radiator & Standard Sanitary corporation

Serving home and industry

AMERICAN-STANDARD • AMERICAN BLOWER • ACME CABINETS • CHURCH SEATS • DETROIT LUBRICATOR • KEWANEE BOILERS • ROSS HEATER • TONAWANDA IRON

American Blower . . . a time-honored name in air handling



Complete fan assembly

Wheel and shaft assembly

SIROCCO INDUCED DRAFT FAN

Memo to Power Plant Men:

You can handle more gas per revolution at lowest tip speed with Sirocco Multi-Blade Fans than with any other type. Designed and proportioned especially for induced draft work, their operating characteristics make them particularly adaptable to your modern power plant needs.

AMERICAN BLOWER

AMERICAN BLOWER CORPORATION, DETROIT 32, MICHIGAN
CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONTARIO
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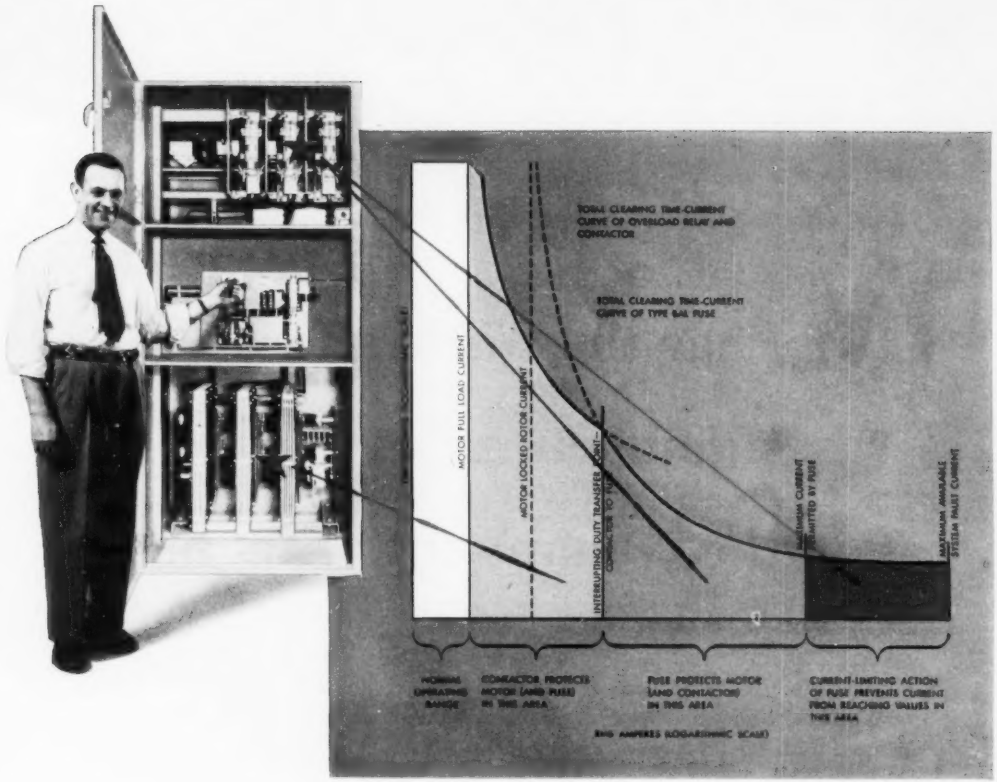

TOTAL CLEARING TIME-CURRENT CURVE OF OVERLOAD RELAY AND CONTACTOR
TOTAL CLEARING TIME-CURRENT CURVE OF TYPE BAL FUSE
MOTOR FULL LOAD CURRENT
MOTOR LOCKED ROTOR CURRENT
INTERRUPTING DUTY, TRANSFER POINT—CONTACTOR TO FUSE
MAXIMUM CURRENT PERMITTED BY FUSE
MAXIMUM AVAILABLE SYSTEM FAULT CURRENT
NORMAL OPERATING RANGE
CONTACTOR PROTECTS MOTOR (AND FUSE) IN THIS AREA
FUSE PROTECTS MOTOR (AND CONTACTOR) IN THIS AREA
CURRENT-LIMITING ACTION OF FUSE PREVENTS CURRENT FROM REACHING VALUES IN THIS AREA
RMS AMPERES (LOGARITHMIC SCALE)

This co-ordinated protection safeguards men, motors and circuits

Men? Motors? Circuits? Which can be ignored at a high-voltage motor installation? Obviously, NONE. Yet, high-voltage protective equipment is often installed that DOES NOT safeguard all three.

Protection must be co-ordinated to be complete. It must safeguard all elements under all conditions. Examine the above chart and note how a Westinghouse High-Voltage Combination Starter co-ordinates fuses and contactor to provide continuous protection for both motors and circuits. Note how the sectionalized steel cabinet protects personnel and equipment.

Co-ordinated protection also safeguards production. No chance for high current faults to bypass the starter and damage equipment. Down time is confined to correcting the fault and then reclosing the circuit.

The advantages of Westinghouse Co-ordinated Protection are many. Talk them over with your Westinghouse representative. Or, write for booklet B-4673 "High-Voltage Motor Starters". Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-27029

YOU CAN BE SURE...IF IT'S
Westinghouse
HIGH VOLTAGE STARTERS

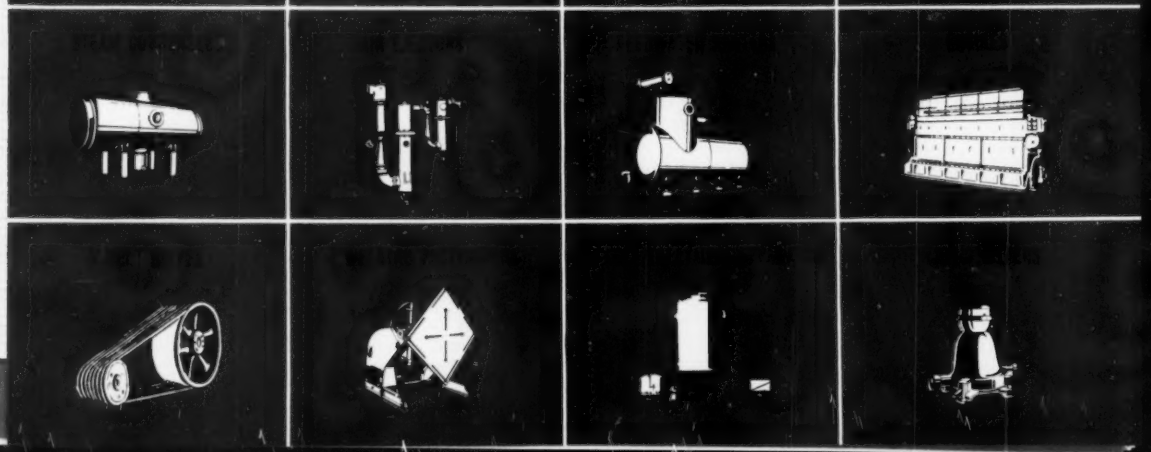
Why has the World's Leading Manufacturer of Pumps taken the "Pump" out of its name?

For 111 years "Worthington" has meant *pumps* to industry everywhere. During this period, Worthington has developed a position of leadership in many related fields. Fourteen major product lines including pumps are manufactured in 21 plants throughout the world.

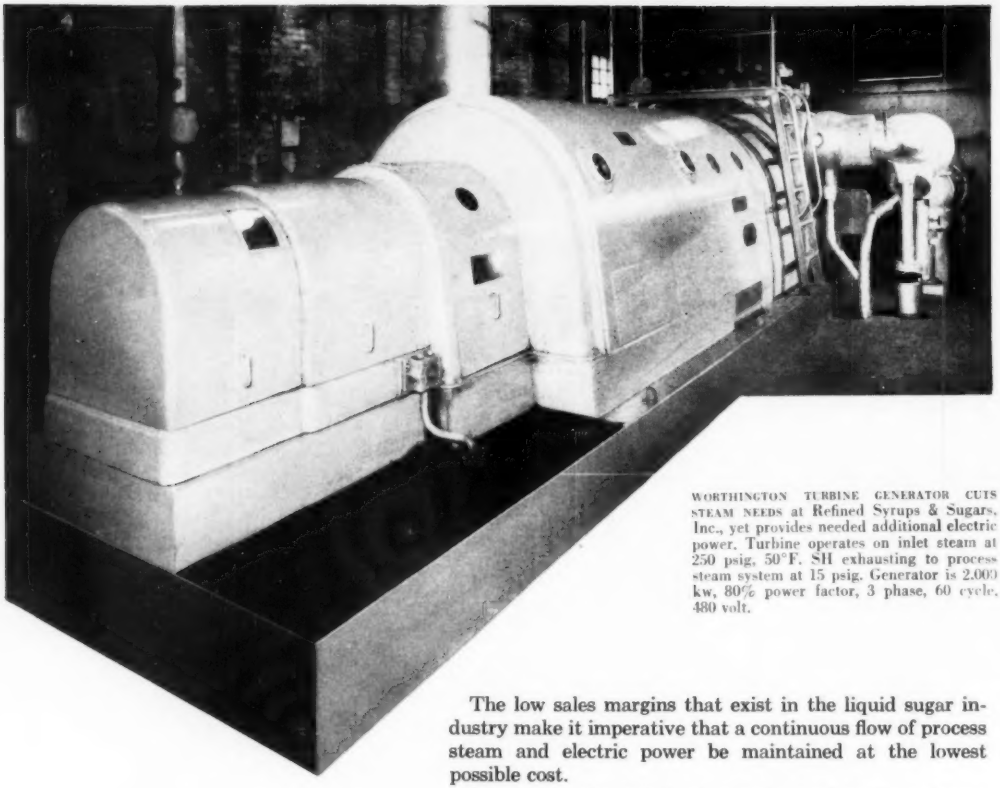
To those we serve, Worthington is *more than pumps*. That's why the world's leading manufacturer of pumps has changed its name from

WORTHINGTON PUMP AND MACHINERY CORPORATION

2.2



The Sign of Value Around the World



WORTHINGTON TURBINE GENERATOR CUTS STEAM NEEDS at Refined Syrups & Sugars, Inc., yet provides needed additional electric power. Turbine operates on inlet steam at 250 psig, 50°F. SH exhausting to process steam system at 15 psig. Generator is 2,000 kw, 80% power factor, 3 phase, 60 cycle, 480 volt.

How Refined Syrups & Sugars got more kw, yet cut steam consumption per kwh by 29%

The low sales margins that exist in the liquid sugar industry make it imperative that a continuous flow of process steam and electric power be maintained at the lowest possible cost.

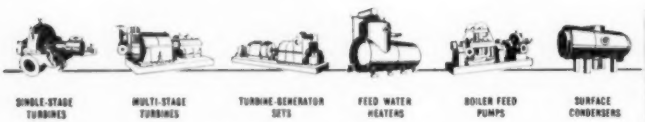
It was with this fact in mind, and a need for more electric power at economical rates, that Refined Syrups & Sugars of Yonkers, New York, replaced existing steam drives with electric motors and installed a modern Worthington 2,000-kw steam turbine generator.

Not only did this arrangement meet the need for added power requirements, but also reduced the amount of steam consumed in generation of power by 29% per kwh.

By going "Worthington", Refined Syrups & Sugars—like the many other Worthington users—found that unit responsibility has its rewards. Each Worthington turbine generator is designed, assembled and tested *as a complete unit* before shipment.

Sizes to 10,000 kw. Worthington Corporation, formerly Worthington Pump & Machinery Corporation, Steam Turbine Division, Wellsville, New York.

T-2.17

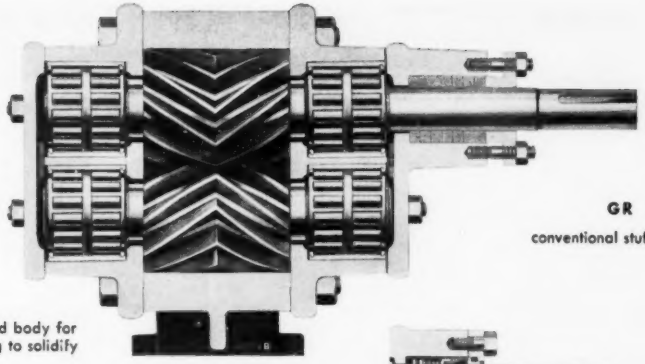


A GREAT TEAM IN STEAM

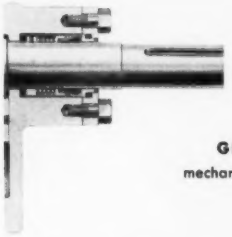
WORTHINGTON

Steam Turbine Generators

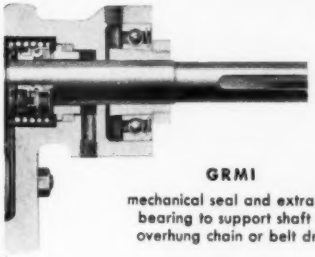
GRJ
steam-jacketed body for liquids tending to solidify



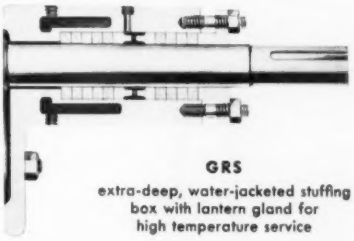
GR
conventional stuffing box



GRM
mechanical seal



GRMI
mechanical seal and extra ball bearing to support shaft for overhung chain or belt drive



GRS
extra-deep, water-jacketed stuffing box with lantern gland for high temperature service

NOW...the most complete line of gear pumps

with interchangeable stuffing boxes to meet varying job requirements

There's a Worthington gear pump now for every service where you want a rotary.

Worthington's GRM with mechanical seal rounds out a line of internal roller bearing rotaries that will fill any requirements from 1 to 5000 gpm; pressures up to 500 psi.

Using the same body, gears and shaft, you can now have a Worthington gear pump for any sealing problem—as shown in the illustration. All parts are interchangeable.

The single stuffing box is subject to suction pressure only.

Better Efficiency, Longer Life with Herringbone Gears

Worthington uses double helical gears on its gear-type rotaries in order to eliminate end thrust, prevent trapping of the liquid, reduce wear on bearing surfaces.

All shafts and plates are the same size for easy interchangeability.

So this new rotary again illustrates the *completeness* of the Worthington line—the fact that "The World's Broadest Line Assures You the Right Pump for Every Job".

Send coupon for new bulletin on Worthington gear-type rotaries. Please attach to your business letterhead.

WORTHINGTON

ROTARY PUMPS

P.I.7

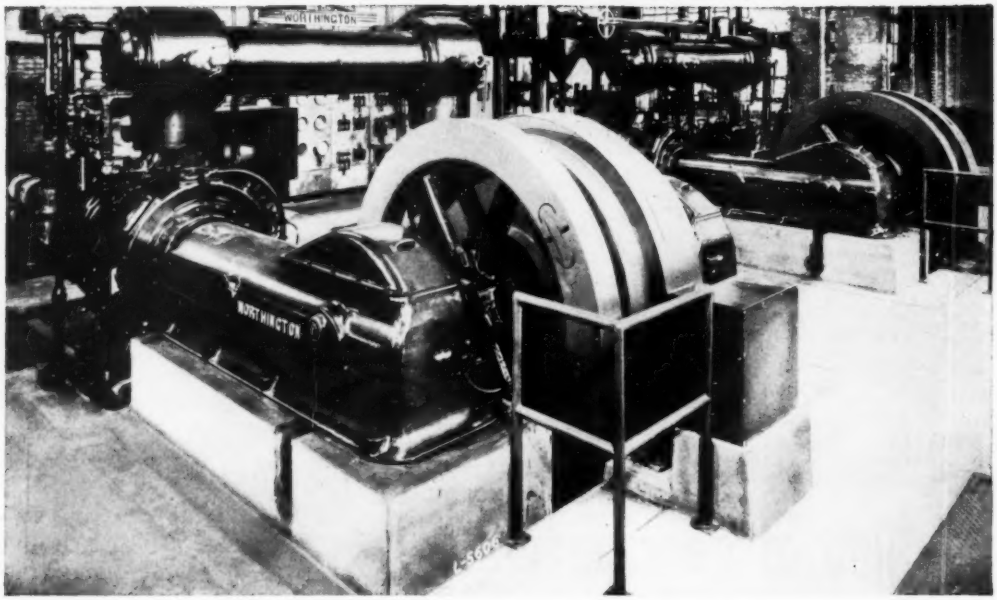
Worthington Corporation, formerly
Worthington Pump and Machinery Corp.
Reciprocating Pump Division
Harrison, New Jersey

NAME.....TITLE.....

COMPANY.....

ADDRESS.....

CITY.....ZONE.....STATE.....



Link-Belt "Hooks Up" with Worthington Air

You can't find a compressed air need that Worthington can't fill.

This installation pictured above is a Worthington DC2 air compressor in Link-Belt Company's Pershing Road plant in Chicago. And that picture could be duplicated all over America where engineering-wise plants insist upon dependable, trouble-free, low-cost air.

One reason is—*only* Worthington makes air compressors with the Feather* Valve. Any other valve is complicated beside this Worthington exclusive. Feather* Valve is the simplest, lightest, most efficient ever made.

Then there's Worthington automatic variable capacity control—acknowledged the most accurate, flexible and simple control obtainable. And Worthington's high-efficiency intercooler that needs less water, less power, less attention.

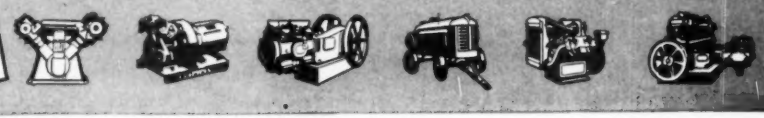
Build around these features with sturdy construction . . . back up the machinery with Worthington application engineering—and you have plenty of reasons for deciding *there's more worth in Worthington.* Worthington makes all auxiliary equipment, too. Worthington Corporation, formerly Worthington Pump and Machinery Corporation, Compressor Division, Buffalo, N. Y.

WORTHINGTON

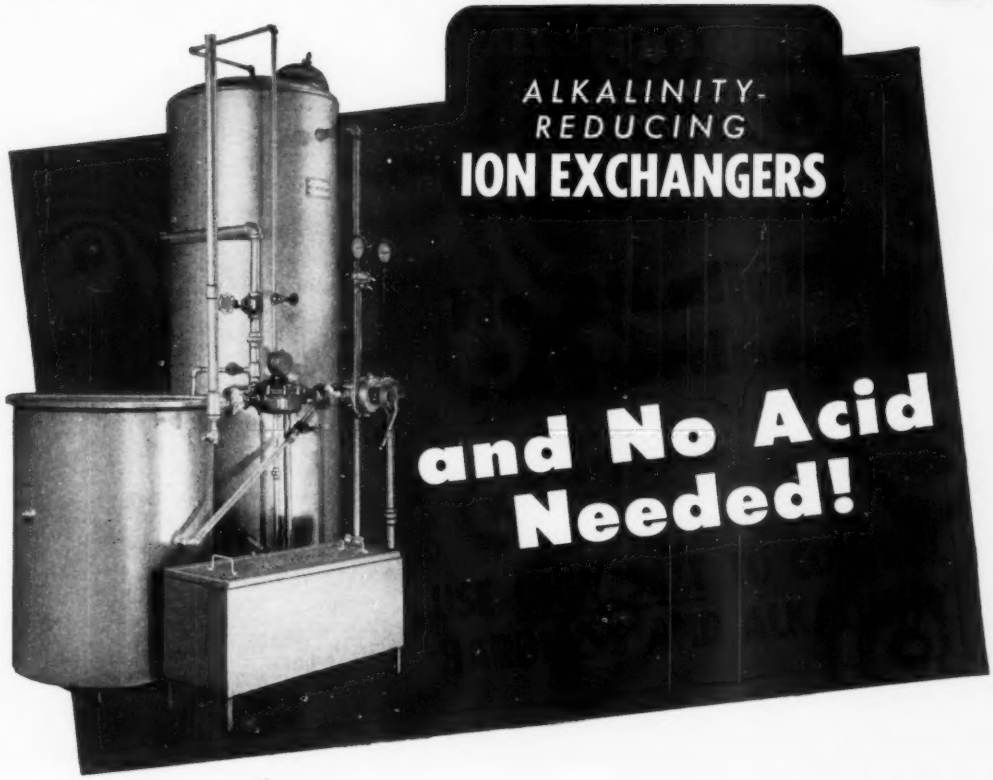
*Reg. U. S. Pat. Off.

K1.9

NO OTHER COMPRESSOR WILL OUTPERFORM A WORTHINGTON



Announcing



ALKALINITY-REDUCING ION EXCHANGERS

and No Acid Needed!

THIS SALT-SPLITTER SYSTEM removes both alkalinity and hardness by means of two resin beds in one tank. Needing only inexpensive salt — no acid — for regeneration, it offers these advantages:

1. Permits operation at alkalinities approaching zero, since no acid is present to damage equipment or produce acid water.
2. Eliminates costly rubber- and lead-lined tanks and piping.
3. Simplifies disposal of spent regenerant.
4. Provides complete safety for operating personnel.

Users of sodium zeolite softeners who find them unsuitable because of the high alkalinity of the effluent or who may be by-passing raw water for boiler make-up should definitely investigate the possibilities of incorporating this system into present installations.

For a concise explanation of the operation of this new combination of two proven water-conditioning methods, get a copy of the new Allis-Chalmers bulletin, 28X7808. Just fill in and mail the coupon.

ALLIS-CHALMERS

Water Conditioning

✓ EQUIPMENT ✓ CHEMICALS ✓ SERVICE

Allis-Chalmers
Milwaukee 1, Wisconsin

Please send Bulletin 28X7808 describing alkalinity reduction by ion exchange.

Name .....

Title .....

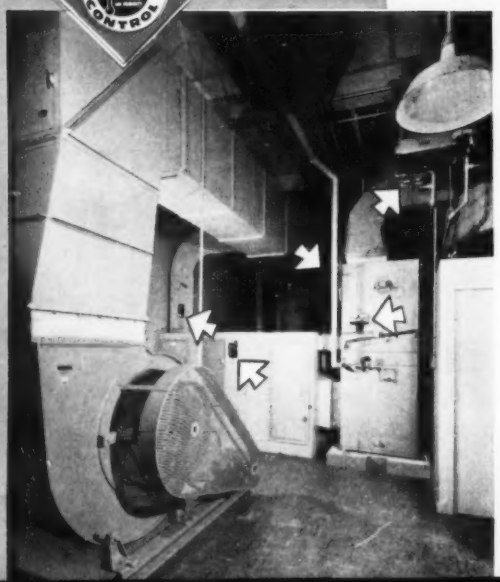
Company .....

Address .....

City ..... State A-3613

POWERS for Heating and

PNEUMATIC CONTROL SYSTEMS

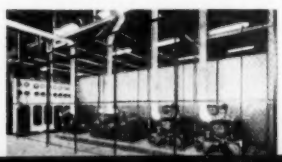


POWERS Design for MODERN CONTROL PANEL

In the unique functional design of this Control Panel are integrated various types of POWERS pneumatic controlling, indicating and recording instruments. It masterminds the operation of four complete year round air conditioning systems in the modern plant shown on the next page.

Photos at left and top and bottom of next page show air conditioning systems regulated by the Control Panel. Arrows indicate Powers controls.

Photo below, left—shows four refrigerator compressors, one for each air conditioning system; photo right—Powers air compressor and pilot valves supplying air pressure for control system.



Air Conditioning

Pull Heating Costs Down As Fuel Prices Rise

Room Thermostat for Offices

POWERS TEMPERATURE and HUMIDITY CONTROL SYSTEMS prevent OVER-heated air in offices, factories, process rooms and other spaces. Comfortable, healthful room temperature—not only increases output of workers, but—

★ **Cuts Heating Costs up to 25%**—Keeping each room at its proper temperature prevents waste of fuel from OVER-heating. With todays much higher fuel costs, bigger savings than ever before are now possible with Powers control.

Constant Temperature and Humidity conditions in each room can be maintained at any predetermined point with Powers control. It can be installed in existing as well as new buildings.

25 to 40 Years of Dependable Service with very low maintenance cost is reported by hundreds of users. Powers control is notable for its continuous accurate performance.

Precision Control for Processes—Wherever product uniformity and quality are dependent upon precise temperature and humidity regulation, use Powers controlling, indicating or recording instruments.

New modern plant commemorating 60th anniversary of The Powers Regulator Co., pioneer in pneumatic operated controls for heating, air conditioning systems and industrial processes.

Phone or write our nearest office for help in selecting the type of automatic control that will give best results for your requirements. There's no obligation.

THE POWERS REGULATOR CO.

Established 1891 • SKOKIE, ILLINOIS • Offices in Over 50 Cities

CHICAGO 13, ILL., 3819 N. Ashland Ave. • NEW YORK 17, N. Y., 231 E. 46 St.
LOS ANGELES 5, CAL., 1808 W. 8th St. • BOSTON 15, MASS., 125 St. Botolph St.
DETROIT 1, MICH., 2631 Woodward Ave. • TORONTO, ONT., 195 Spadina Ave.
PHILADELPHIA 32, PA., 2240 N. Broad St.

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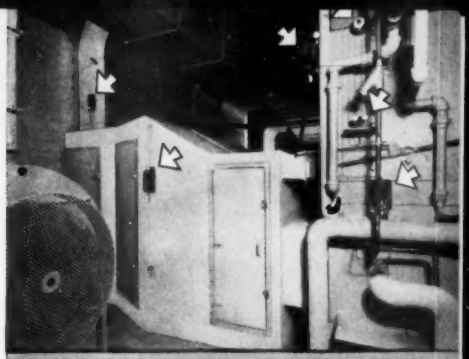


POWERS

Above: Arrows indicate some of the many controls applied to air conditioning system: Powers Duct Hygrostat, Duct Thermostat, Pneumatic Switch, Diaphragm Valves and Damper Motors Static Pressure Regulators, etc.

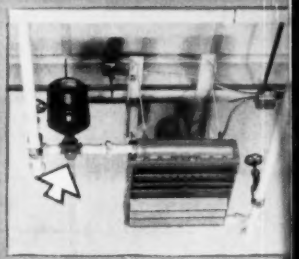
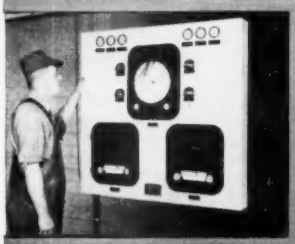
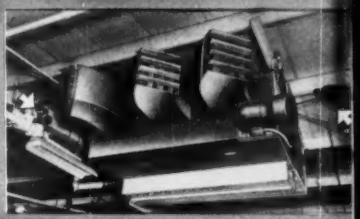


Photo at right shows ceiling type unit heater used in factory. It is controlled by wall type thermostat which also regulates Vulcan fin type radiation below windows.

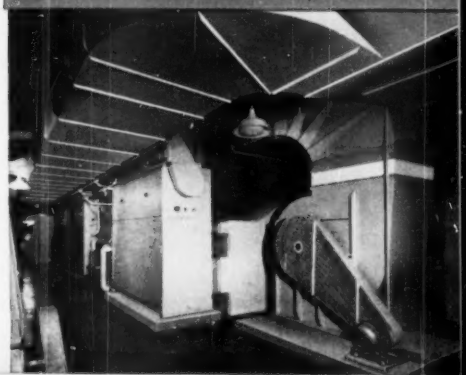


Left: Instrument panel for Powers **MASTROL** System of forced hot water temperature control for heating.

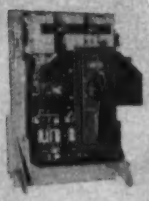
Below: Factory fresh air ventilating units heat and filter outdoor air, providing two air changes per hour in winter and ten in summer.

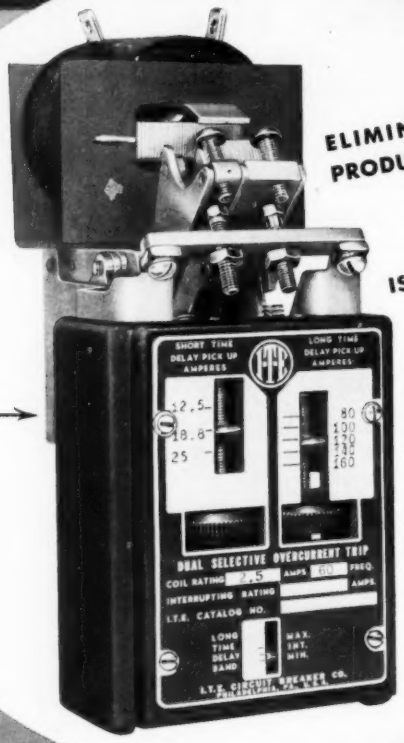


POWERS



SERVICE CONTINUITY





ELIMINATES COSTLY PRODUCTION BREAKDOWNS

ISOLATES SYSTEM FAULTS

SAVES UP TO 63% ON INITIAL INVESTMENT

Direct-Acting Selective Overcurrent Trip Devices are available for I-T-E KA, KB, KC, and LG type circuit breakers in the following ratings:

15,000 to 100,000 amperes interrupting capacity

100 to 6000 amperes continuous

MODERN I-T-E DIRECT-ACTING SELECTIVE TRIP BREAKER PROTECTION

It's easy to protect production and profits against disastrous total power failure in complex electrical distribution systems. The cost is lower than you think.

Modern Selective Tripping—pioneered and developed by I-T-E—eliminates the failings of inadequate systems which can tie up an entire plant or utility with a single short somewhere along the line.

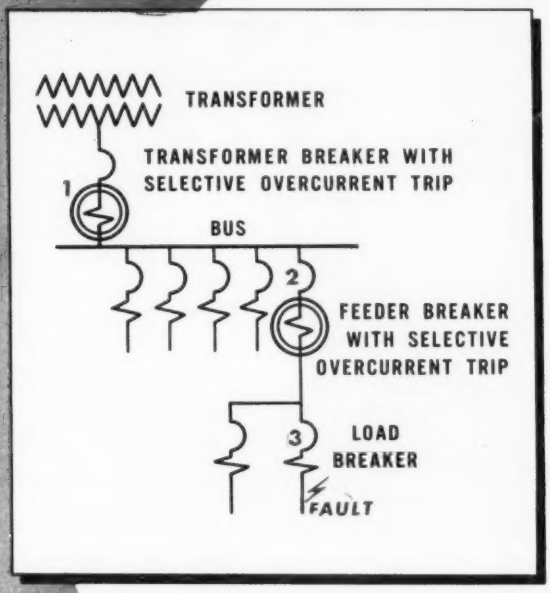
Selective Tripping limits the fault to *one* affected area only. Production continues—*uninterrupted*—throughout the rest of the system.

I-T-E TRIP DEVICE SAVES 63% ON INVESTMENT

Secret of this efficient delayed-action circuit breaker protection is the I-T-E *Direct-Acting* Selective Overcurrent Trip Device. Developed by I-T-E engineers to replace complex, expensive transformer-relay auxiliary apparatus, this unique tripping device gives one more reason for I-T-E leadership in the design and application of quality circuit breakers and switchgear.

Positive—compact—dependable, the low-cost I-T-E Trip Device saves you up to 63% on accessory cost per circuit! And because it is a *direct-acting* device—an integral part of the circuit breaker—no additional space is required on your switchboard panel. Assure service continuity. Install I-T-E Selective Tripping in *your* plant.

COSTS LESS THAN YOU THINK



HOW SELECTIVE TRIPPING WORKS

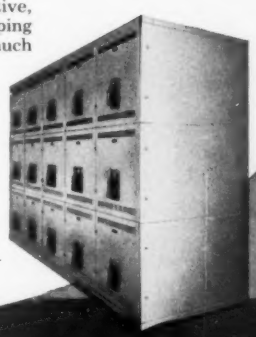
I-T-E circuit breakers, arranged in series, are *preset* to open in *definite sequence* (3, 2, 1 in diagram). If there is a sudden overcurrent or short circuit in any branch of the system, only the breaker (3) closest to the fault will open. Other breakers—other production machinery—in the system are unaffected.

ANOTHER I-T-E "FIRST"

Here is one more I-T-E "first"—another major I-T-E development to help industry protect production and save. Originally developed for the Navy during the War, the I-T-E Direct-Acting Selective Overcurrent Tripping Device has since been refined and perfected for industrial and utility use.

Call on I-T-E engineers—specialists in circuit breakers and switchgear—to see how positive, dependable I-T-E *Direct-Acting* Selective Tripping can protect your plant operation. See how much you can save.

For selection and application data on I-T-E large air circuit breakers, including selective tripping arrangements write for Catalog Section 1003 today. I-T-E Circuit Breaker Co., 19th and Hamilton Sts., Phila. 30, Pa.



I-T-E

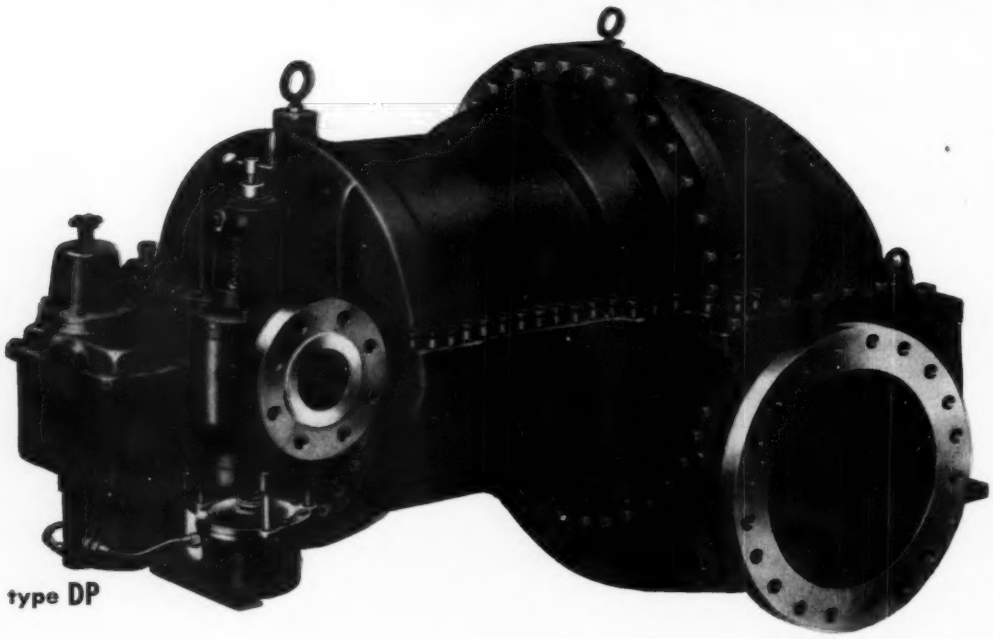
LOW-VOLTAGE SWITCHGEAR

I-T-E CIRCUIT BREAKER CO. • 19TH AND HAMILTON STS. • PHILADELPHIA 30, PA.

CANADIAN MFG. AND SALES: EASTERN POWER DEVICES, LTD., TORONTO • EXPORT SALES: PHILIPS EXPORT CORP., N. Y. 17, N. Y.

General Electric Announces

A NEW ADVANCE IN



type DP

Custom Performance from Standard Turbine Drives now possible through new Designs and Manufacturing Methods

Now you can select the mechanical-drive turbine that will give you maximum mechanical power for your fuel dollar . . . and without the delay and expense of special engineering. General Electric's four new multi-stage drives are *standards,* designed to meet your *specific* requirements.

Four new governing systems give you a wide selection of performance ratings. A new sectional valve gives you greater efficiency for part load operation. Many other improvements make these the finest turbines of their size General Electric has ever produced.

Secret of their adaptability is in the method of manufacture. By using interchangeable casting patterns, designed to be combined in a variety of ways, it's possible for the factory to "customize" standard machines for individual applications. You get a better turbine, designed for your job, and the delivery time is shorter, the cost lower.

Get the full particulars on these new multi-stage turbine drives. Write for our new bulletin, GEA-5580, "G-E Multi-Stage Turbine Drives." General Electric Company, Section 252-53, Schenectady, N. Y.

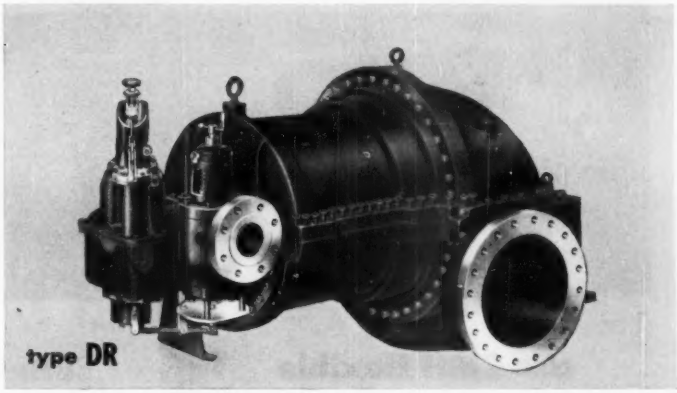
GENERAL ELECTRIC

252-53

MULTI-STAGE TURBINE DRIVES

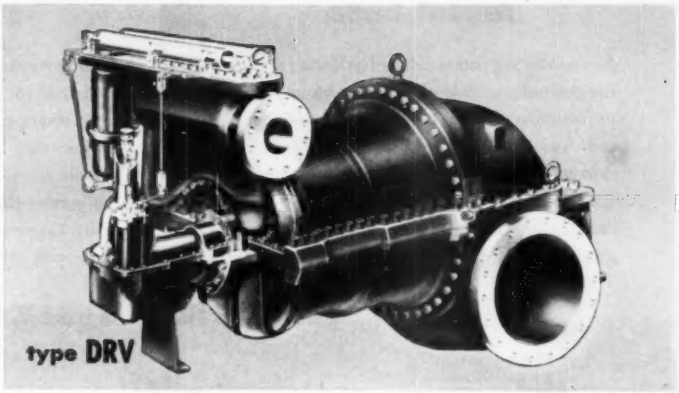
type DP

Dependable power over a 30 per cent adjustable speed range.



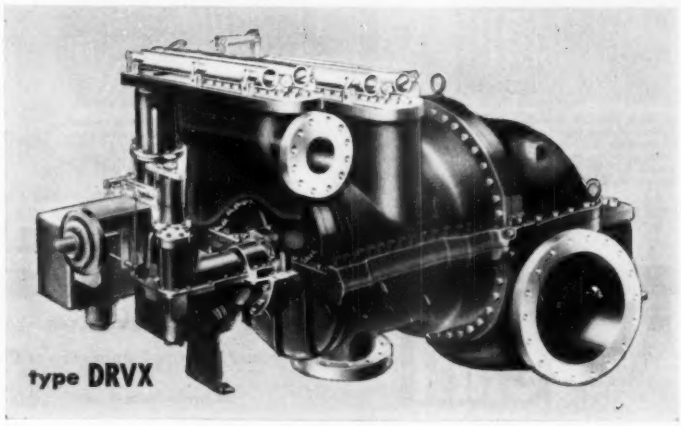
type DR

Oil-relay governor makes possible a speed range of 6 to 1, with only 4 per cent regulation and ½ per cent steady state speed variation.



type DRV

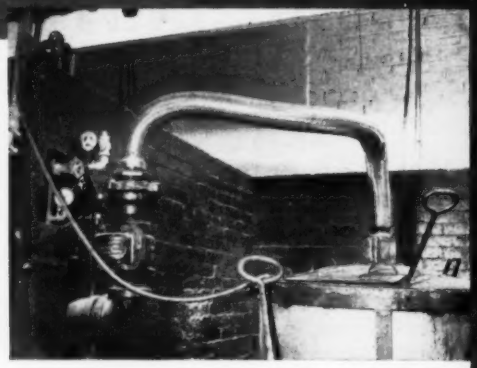
Automatic sectional valves linked to the oil-relay governor minimize throttling losses under fluctuating load factors, make possible substantial operating savings.



type DRVX

For applications where process steam is desired at a definite, steady pressure. Extracted steam pressure remains constant even when load on the unit fluctuates and the flow of extracted steam varies.

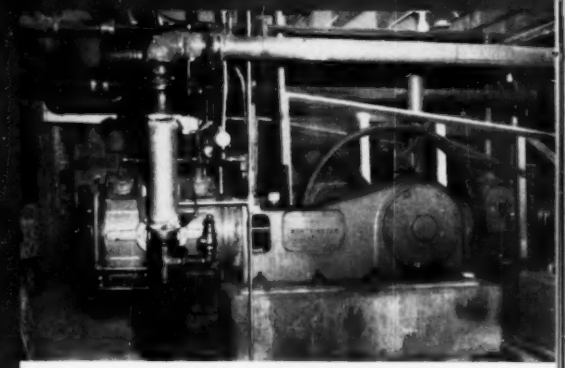
IF the connection must move . . .



use CMH flexible metal hose

In conveying materials—liquids, gases or dry granular solids—between two movable points, metal hose combines rugged durability with the required flexibility. In addition, metal hose is non-aging, non contaminating and non-collapsible. It offers high resistance to heat, cold and physical damage, giving excellent service under all conditions.

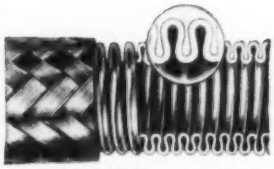
IF the connection vibrates . . .



use CMH flexible metal hose

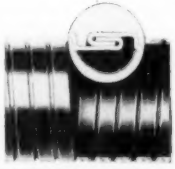
Connections subject to vibration will last longer if they are made with flexible metal hose. Equipment and rigid piping will last longer, too, because metal hose isolates the vibration, restricting it to that portion of the equipment that is built to absorb the vibration. Transmission of noise is minimized also, with metal hose connections.

There is a size and type



CMH REX-WELD corrugated steel and bronze hose is available in standard sizes from 3/16" through 12" I.D. for burst pressures to 12,000 psi, temperatures to 1000° F. Available with or without metal braid covering.

CMH REX-FLEX corrugated stainless steel hose is available in standard sizes from 9/16" through 6" I.D. for burst pressures to 24,000 psi, temperatures to 1600° F. Available with or without metal braid covering.



CMH REX-TUBE fully interlocked flexible tubing for ducting, exhaust, armor etc. is available in galvanized steel, aluminum, brass and other metals in sizes 1/2" through 12", I.D.

Descriptive literature available on all CMH hose types.

CMH

Flexon identifies CMH products that have served industry for over 50 years

CHICAGO METAL HOSE

1301 S. Third Avenue Maywood, Illinois

In Canada: Flexonics Corporation of Canada, Ltd., Brampton, Ontario

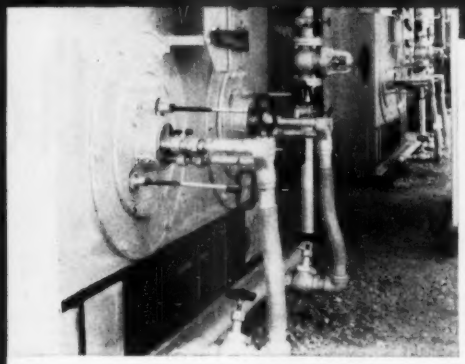
Manufacturers of Flexible Metal Hose, Metallic Bellows,

IF the connection is misaligned . . .

use CMH flexible metal hose

Joining misaligned sections of piping is greatly simplified when flexible hose is used to bridge the gap. Savings in assembly time and in fittings generally will pay the cost of the hose. At the same time, metal hose provides a neater installation that is practical, efficient and completely leaktight and dependable.

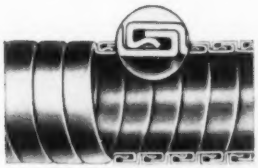
IF the connection absorbs expansion . . .



use CMH flexible metal hose

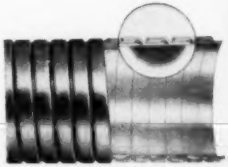
In the many types of equipment where thermal changes cause expansion and contraction, the motion is easily absorbed by flexible metal hose without sacrificing any of the tightness or dependability of the connection. Flexible metal hose makes it possible to solve an otherwise difficult problem quickly, simply and economically.

to meet every need . . .



CMH REX-TUBE fully interlocked flexible metal hose for steam, tar and asphalt, grease, etc. is available in galvanized steel or bronze in standard sizes from ⅛" to 12", I.D.

CMH REX-TUBE ball bearing type utility hose for non-searching fluids is available in bronze, galvanized steel or stainless steel in standard sizes from 3/32" through 1½", I.D. Available with or without metal braid covering.



CMH "Abrasion Resistant" flexible galvanized steel tubing is especially designed for handling dry granular solids such as grain, slag, ashes, etc. Standard sizes 2⅛" through 12", I.D

See your classified telephone directory for the distributor nearest you.

Division, Flexonics *Corporation*

Plants at Maywood, Elgin, Rock Falls and Savanna, Illinois and Memphis, Tennessee

Expansion Joints for Piping, and Aircraft Components

Industries served by VU Boilers

Aircraft
Asphalt
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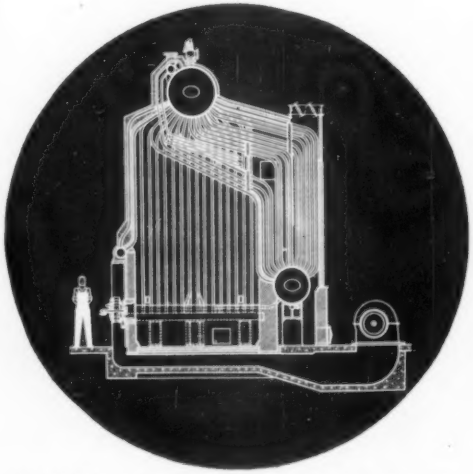
Explosives
Electrical Equipment
Electric Power
Food Products
Foundries
Gas Works
Gelatine
Glass
Hosiery
Knitting Mills
Institutions
Laundries
Leather
Linoleum
Locomotive
Lumber
Machinery
Metal Producing
Mining
Municipal
Oil Refining
Paint
Paper
Public Utilities
Radio
Railways
Refrigeration
Rubber
Schools
Sewage Plants
Shipbuilding
Sugar
Textile
Tobacco
U. S. Government

in Industry after Industry Leaders choose VU



VU-10 Boiler — This oil or gas fired unit is in a Southwestern plant. Capacity — 60,000 lb of steam per hr; operating pressure — 150 psi; steam temperature — 465 F. VU-10 capacities range from 10,000 to 60,000 lb of steam per hr.

COMBUSTION ENGINEERING

ALL TYPES OF BOILERS, FURNACES, PULVERIZED FUEL SYSTEMS AND STOKERS; ALSO SUPERHEATERS, ECONOMIZERS AND AIR HEATERS

THE story's the same, wherever you go . . . in industry after industry . . . wherever steam is used . . . C-E Vertical-Unit Boilers will be found in the plants of many of the leading companies.

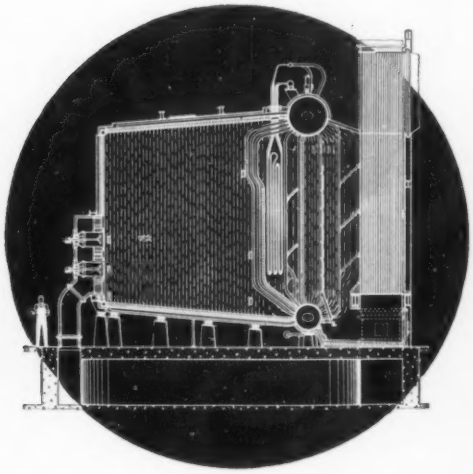
The Petroleum Industry, for example . . . one of the largest users of steam for process and power . . . has installed VU Boilers with an aggregate capacity of many millions of pounds of steam per hour. The list below gives evidence of the widespread acceptance of the VU Unit among leaders of the petroleum industry.

Several of these companies have ordered and re-ordered VU Boilers over a period of years. One company, for instance, ordered its first VU in 1937; another was ordered in 1940, two more in 1942 and another in 1947. The sixth unit was installed in 1950. They know by actual experience what they can expect from a Vertical-Unit Boiler.

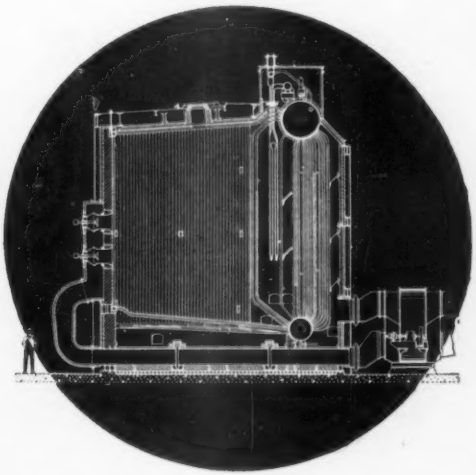
So, if you use steam . . . from 10,000 to 350,000 pounds per hour . . . for power or process, take your cue from the petroleum industry — or from any other field where steam is of primary importance. Investigate the lower steam costs you get with the advanced design . . . sound construction . . . consistent reliability of C-E Vertical-Unit Boilers.

Typical Group of Oil Companies that have purchased VU Boilers for one or more plants

Arabian American Oil Company
Cit-Con Oil Corp.
Cities Service Refining Company
Creole Petroleum Corp.
Esso Refinadora do Petroleos
Gulf Oil Company
Humble Oil & Refining Company
Magnolia Petroleum Company
Pan American Refining Company
Petroleos Mexicanos
The Pure Oil Company
Sinclair Refining Company
Socony Vacuum Oil Company
Stanolind Oil & Gas Company



VU-50 Boiler — This unit is one of two duplicates at an Eastern plant. They are fired with oil or gas. Capacity — 100,000 lb of steam per hr; operating pressure 550 psi; steam temperature — 700 F.



VU-50 Boiler — This is the latest of three duplicate units installed in this Western plant. Fired with oil or refinery gas. Capacity — 250,000 lb of steam per hr; operating pressure — 565 psi; steam temperature 650 F.

B-571

— SUPERHEATER, INC.
200 MADISON AVENUE, NEW YORK 16, N. Y.

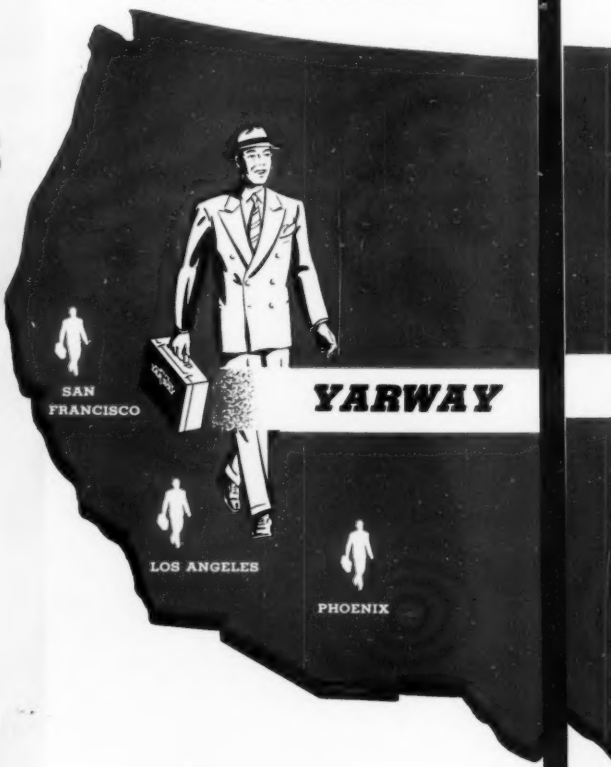
C-E

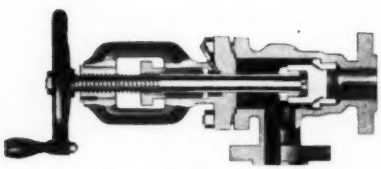
blow-down lines at all pressures in more than 15,000 boiler plants from coast-to-coast are kept tight by

YARWAY

Blow-Off Valves

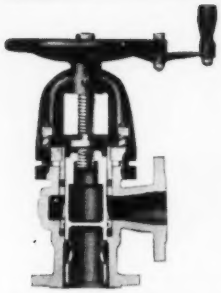
Type B Seatless Tandem Valve combining two angle valves. Iron body for pressures to 250 psi. Steel body for pressures to 400 psi. See Yarway Bulletin B-425.



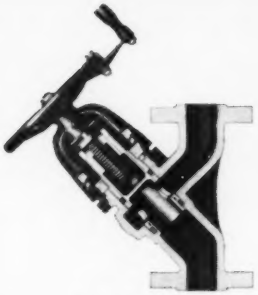


Hard Seat Blow-Off Valve (angle) cone-seat and disc type, with mated stellite seat and disc. Made for pressures up to 2500 psi, flanged or welding ends. See Bulletin B-433.

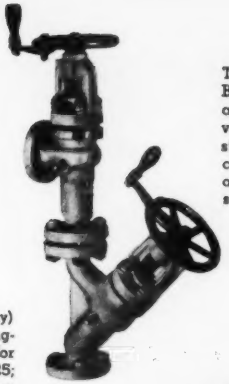
YARNALL-WARING COMPANY
100 Mermaid Avenue, Philadelphia 18, Pa.
BRANCH OFFICES IN PRINCIPAL CITIES



Seatless Blow-Off Valve (angle) with no seat to score, wear, clog or leak. Type B (shown) for pressures to 400 psi, see Yarway Bulletin B-425; Type C for pressures to 1500 psi, see Bulletin B-433.



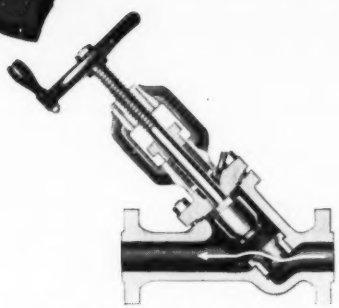
Seatless Blow-Off Valve (straightway) sectioned to show balanced sliding plunger in open position. Type B (shown) for pressures to 400 psi, see Bulletin B-425; Type C Seatless Valves for higher pressures, see Bulletin B-433.



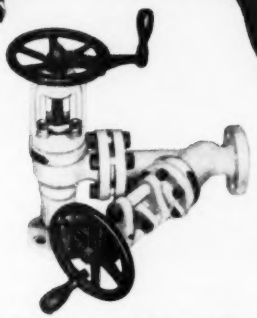
Type C Seatless Tandem Blow-Off Valve combining angle and straightway valves. Angle-angle and straightway-straightway combinations also available. Pressures to 600 psi, see Bulletin B-433.

Yarway engineers are conveniently situated in 16 cities in the U.S., and experienced representatives in other cities as well as Canada, Hawaii, Philippines and Latin America. They are constantly working for better, more economical steam plant operation. When that is your problem—call a Yarway man.

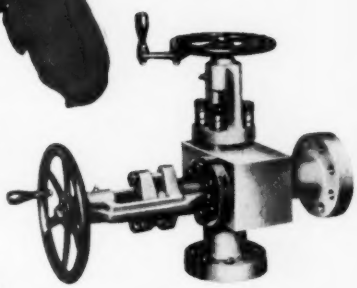
SERVICE GOES ALL THE WAY . . .



Hard Seat Blow-Off Valve (straightway) sectioned to show mated stellite seat and disc in open position. For pressures to 2500 psi. See Bulletin B-433.



Hard-Seat—Seatless Tandem Valve. Hard seat is the blowing valve; seatless is the sealing valve. Available in any combination of angle or straightway bodies, flanged or welding ends. For pressures to 1500 psi. Hard seat—Hard seat Tandems for pressures to 2500 psi. See Bulletin B-433.



Unit Tandem Blow-Off Valve, combining hard-seat blowing and seatless sealing valve in one-piece forged steel body for pressures to 1500 psi. Two hard-seat valves in tandem also available for pressures to 2500 psi. See Bulletin B-433.

EASILY REMOVABLE CIRCUIT BREAKER facilitates inspection or replacement. This *vertical-lift* breaker cannot be moved in or out of operating position unless contacts are open.

AUTOMATIC G-E LOAD-RATIO-CONTROL unit eliminates separate voltage regulator. Control panel shown above has raise and lower push buttons, position indicator and operations counter. Some G-E LRC units have made over 1,000,000 tap changes without appreciable wear.

Utility finds quick answer to growing loads with G-E Packaged Substations

QUICK INSTALLATION: This G-E substation for the Western Massachusetts Electric Co. was trucked directly to site of installation, bolted to waiting foundation, connected to high-side and feeder cables, and placed in operation.

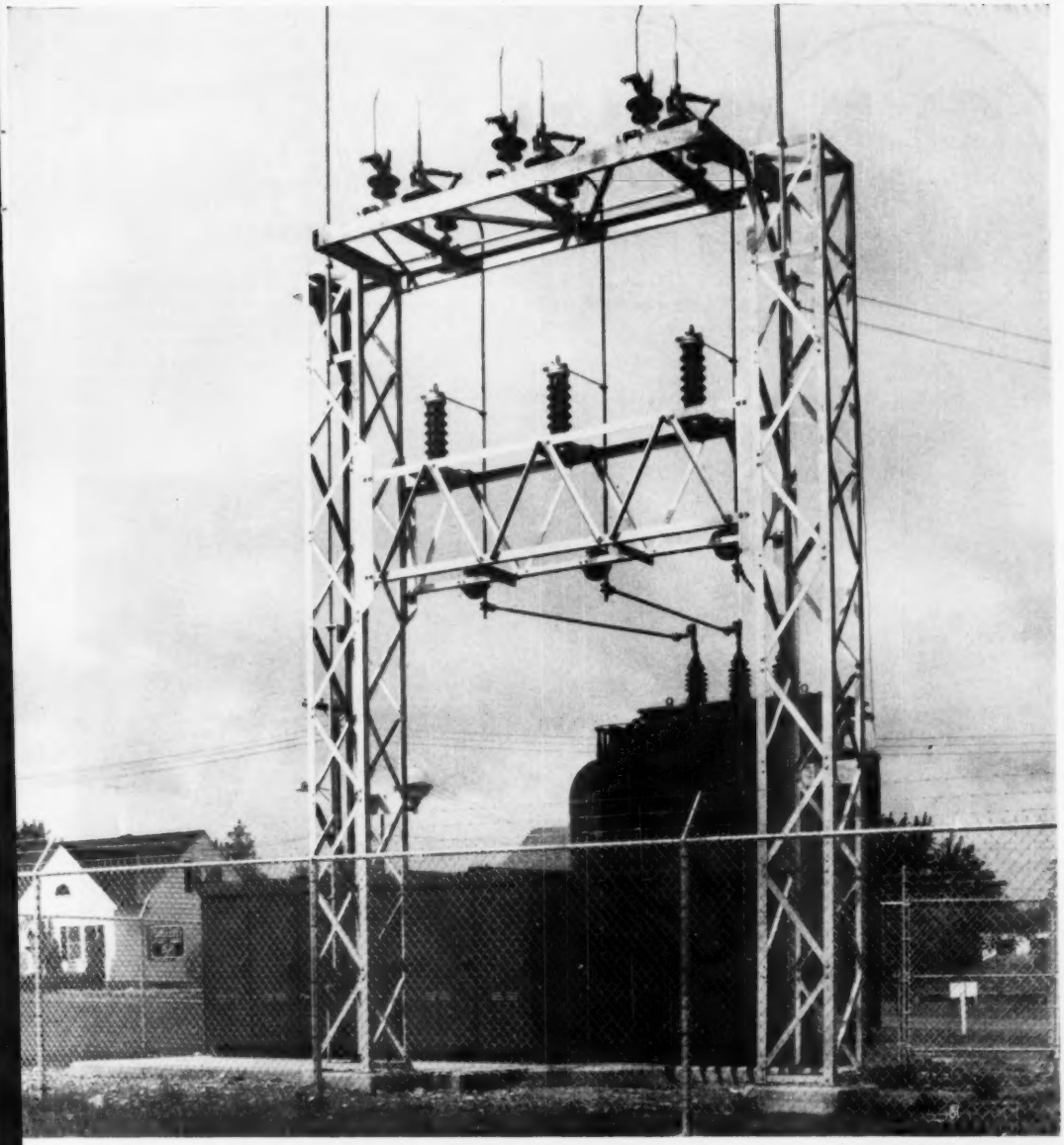
Standardized factory-assembled substations simplify utility expansion.

Faced with rapidly growing loads on one side of Pittsfield, Mass., the Western Massachusetts Electric Company found a ready answer when it ordered and installed the G-E unit substation shown at left. By selecting a standard unit directly from G-E specifications, it not only got quick delivery of a complete, ready-to-operate substation, but also saved time and money all along the line—from initial planning through to final installation.

When the need for further substation capacity developed on the opposite side of town, standardized equipment again was the answer—even to the necessary steel structure, as shown in the photograph on the opposite page.

The trend to standardized equipment, as the logical cost-saving way to meet growing loads, is evident in utility expansion programs across the country. Because of their great flexibility, G-E unit substations are applicable to a wide variety of system arrangements. For full information, write for Bulletins GEA-3800 and GEA-4500. *General Electric Co., Schenectady 5, N.Y.*

321-76



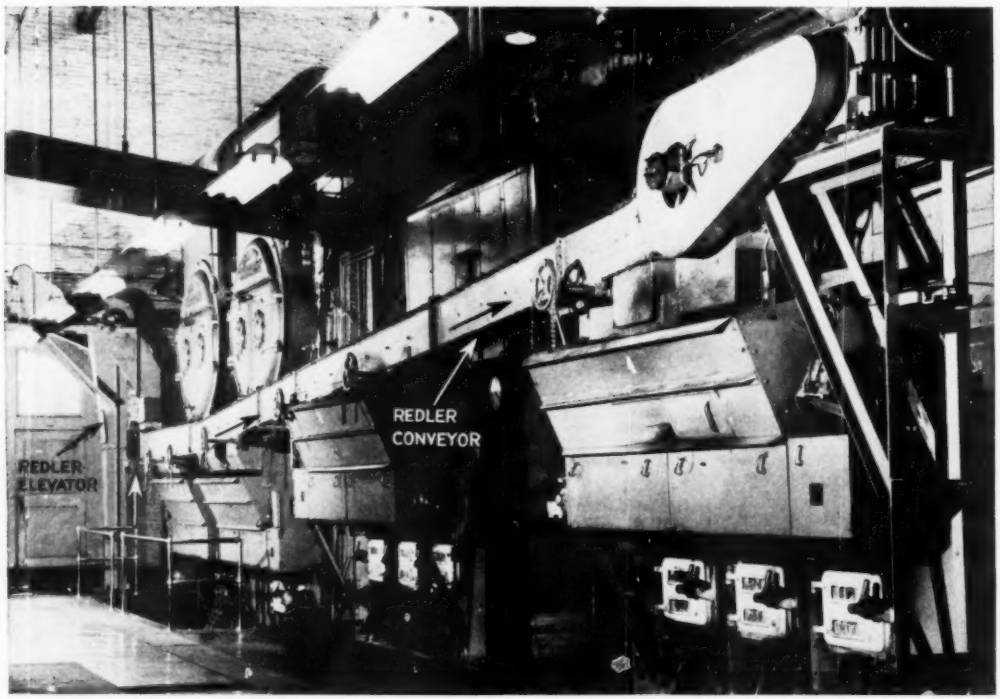
EVERYTHING STANDARD—INCLUDING THE STRUCTURE: One of the latest substations installed by the Western Massachusetts Electric Company, this unit was supplied complete, even to the steel structure for the incoming high-voltage lines. Standardized equipment like this eliminates weeks of detailed planning and engineering, simplifies purchasing. Trained engineering personnel have more time for the important work of broad system planning. The trend is to "standards"!

GENERAL ELECTRIC

S-A CONVEYING *Systems* for Faster, Cleaner COAL HANDLING

Here's where an S-A REDLER coal handling system made possible a neat, clean boiler room free from coal dust. Also, the extremely compact REDLER casings fit snugly into place . . . occupy little space.

Whether you need a REDLER system such as this, a belt conveyor layout or some other arrangement, S-A engineers are well qualified by experience and a complete line of equipment to help you find the one best handling system that will meet your requirements at the lowest cost per ton. Write us about *your* coal handling problems . . . there is no obligation, of course.



In this modern plant a REDLER Conveyor, slightly inclined from horizontal, conveys coal directly to a series of stoker hoppers. A system of REDLER handling units receives, stores, reclaims and delivers coal to the boiler room. Compact REDLER casings overcame difficult space problems—dust-tight construction eliminates coal dust from boiler room and plant.

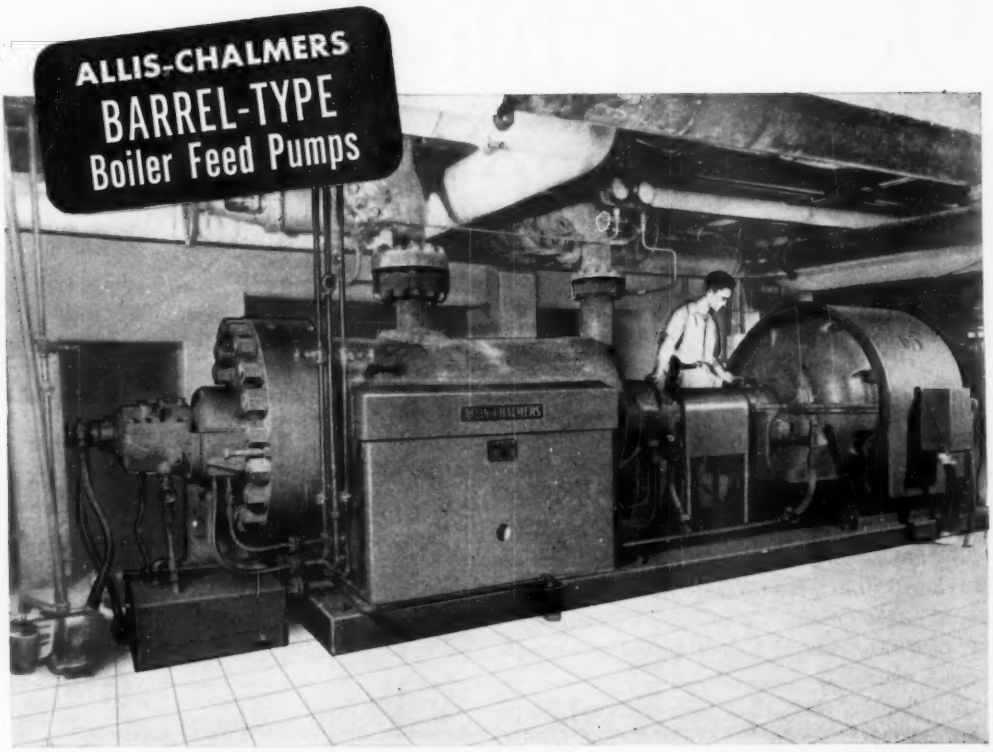
Belt Conveyors
Belt Trippers
REDLER Conveyor-Elevators
ZIPPER Conveyor-Elevators
Weigh Larries
Crushers, Roll & Ring Type
Bucket Elevators
Gravity Discharge Conveyors
Pivoted Bucket Carriers
Flight & Chain Conveyors
"Natural Frequency" Vibrating Conveyors
Screw Conveyors
Skip Hoists
Belt, Pan & Plate Feeders
Pan Conveyors
Track Hoppers & Bin Gates
Conveyor Belt Cleaners
Headshaft Holdbacks
Speed Reducers & Bearings
Car Pullers & Spotters
TELLEVEL Bin Level Controls
Hoists & Winches
Centrifugal Pilers
Water Intake Screens
SEALMASTER Ball Bearing Units

Write for a bulletin on any of the above

STEPHEN S-A DAMSON MFG. CO.

5 Ridgeway Avenue, Aurora, Illinois — Los Angeles, Calif., Belleville, Ontario

DESIGNERS AND MANUFACTURERS OF ALL TYPES OF BULK MATERIALS HANDLING EQUIPMENT



Install New Boiler Feed Pumps at South Carolina Electric and Gas

WHEN 50,000 KW CAPACITY WAS ADDED to Plant Hagood, South Carolina Electric and Gas Company, Charleston, South Carolina, this well know utility chose Allis-Chalmers barrel-type boiler feed pumps. The installations consists of two units like the one shown above. The pump is a 6x6, 11 stage rated at 485,000 lbs/hr or 1055 gpm at a total head of 4100 feet or 1630 psig. Water temperature is 300° F. The motor is an Allis-Chalmers two pole machine rated 1250 hp at 3575 rpm.

Allis-Chalmers barrel-type boiler feed pumps are proving their reliability and low cost of operation in a number of similar installations. Performance records have been such that more than 60 have been ordered for plants now being built.

Engineering Features

Proved engineering features mean you can depend on good performance and low maintenance. Single-stage back-to-back impellers balance axial forces without the use of a balancing drum. First stage has twin, half-capacity impellers to give the advantages of low NPSH. Expansion joint is on the outside of the pump. No flexible internal members are required to compensate for expansion.

Sizes range from 1200 to 3000 psig and from 300 to 2500 gpm. Allis-Chalmers can supply the complete boiler feed pump package including pump, motor, and control of coordinated design and manufacture.

Get the details of this modern-design, performance-proved boiler feed pump from your Allis-Chalmers District Office or write Allis-Chalmers, Milwaukee 1, Wisconsin.

A-3672

ALLIS-CHALMERS

Do you have boiler like these?

Here are 8 "case histories" telling how leading companies solved their boiler plant problems. You'll note that there are small boilers and large boilers—all types of fuels, including alternate fuels—different load characteristics—and different uses for steam.

The two things all these plants have in common are HAYS COMBUSTION CONTROL and a record of continuing excellent results—top efficiencies, greater capacity, high CO_2, reduced fuel, labor and maintenance expense, etc.

In each boiler plant, Hays instruments and control were tailored to the specific conditions and requirements . . . "packaged" in a handsome panel . . . and engineered for the results desired.

Here's how to find out the details which can help you in solving your boiler plant problems. Select the "case history" which is close to your conditions and requirements—and then check the attached coupon. You'll get complete factual details of the boilers and related equipment, load characteristics, fuels, and fuel handling, as well as an explanation of the operation of the control system complete with schematic drawings.

get these factual

RESULTS STORIES

	To recondition or add new boiler To get better process load regulation	To get better efficiency. To get more out of boiler due to rising load
	AMERICAN TOBACCO COMPANY	RAYBESTOS-MANHATTAN COMPANY
BOILERS	Three (one standby)	Four
RATING	16,500 lb per hr	19,650 lb per hr
LOAD SWINGS	Total fluctuation up to 20,000 lb per hr	Moderate load swings
FUEL	Coal	Coal
STEAM USE	Power and process	Process pumps, compressors and heating
results	"The Hays instruments and controls through greater efficiency . . . gave us the solution . . . that of increasing steam capacity and accurate automatic control of the load."	"Our basic reason for installing the Hays Control was to obtain better efficiencies. Our aim was more than reached . . . efficiency . . . 79.3%."

American Tobacco Co.

Raybestos-Manhattan Co.

THE HAYS CORPORATION
MICHIGAN CITY 3, INDIANA

Automatic Combustion Control • Boiler Panels • Hays-Penn Flowmeters
Veriflow Meters and Veritrol • Gas Analyzers • Draft Gages
Combustion Test Sets • CO_2 Recorders • Electronic Oxygen Recorders

plant problems

To make possible easy future expansion with maximum fuel flexibility	To lower operating costs while handling load fluctuations	To modernize plant and to increase boiler plant efficiency	To get accurate control of pulverized coal and oil firing through load swings	To meet varied manufacturing demands and to achieve savings in fuel and labor	To get greater capacity while operating at top efficiency
A. B. DICK COMPANY	**SUNSHINE BISCUIT COMPANY**	**FALSTAFF BREWING CORPORATION**	**BEMIS BROS. BAG COMPANY**	**BALDWIN LOCOMOTIVE WORKS**	**SCOVILL MFG. CO.**
Three	One, plus steam generator incinerator	One	Two	Three	Two
25,000 lb per hr each	31,500 lb per hr	48,000 lb per hr	70,000 lb per hr and 80,000 lb per hr	160,000 lb per hr	One 225,000 lb per hr One 150,000 lb per hr
5–10,000 lb per hr fluctuation without warning	Daily variation 20,000 lb per hr	Fluctuates 12,000 to 28,000 lb per hr	Daily variation 15,000 lb per hr	Intermittent, no warning swings up to 100,000 lb per hr	Load swings up to 60,000-70,000 lb per hr
Coal or gas	Oil	Coal	Oil and coal	Coal and oil	Coal and oil
Heating and process	Process	Heating and process	Power, process and heating	Heating and process	Power, heating and process
"Because of its simplicity (Hays Combustion Control) has enabled us to change quickly from coal to gas firing . . . aided us to achieve 73% efficiency rating in winter—71% in summer."	"Our management and operating crew are well pleased with the new (Hays) unit . . . low maintenance costs . . . equipment enables us to keep close watch over our operating costs."	"Our boiler is operating at 82% efficiency and our maintenance expense bill has been cut 65% . . . our fuel bill has decreased by several hundred dollars per month."	"We have made test runs using the Hays Automatic Combustion Control System, bringing the load rapidly up from 8,000 lb per hr to 80,000 lb per hr with excellent results."	"Our Hays Combustion Control System has aided us substantially in cutting our fuel, labor, and maintenance expense . . . saved 30,000 tons of coal per year . . . we operate with 42 less men than were formerly used."	"We are meeting steam demands up to 400,000 lb per hr achieving an evaporation rate of 12.8, a fuel cost per kw of $.0049, and a cost per 1,000 lb of steam of $.706."

A. B. Dick Company

Sunshine Biscuit Co.

Falstaff Brewing Corp.

Bemis Bros. Bag Co.

Baldwin Locomotive Works

Scovill Mfg. Co.

The Hays Corporation, Michigan City 3, Indiana
I've checked the RESULT STORY(S) that cover the conditions in my plant. Please send it immediately.

- ☐ American Tobacco Co.
- ☐ A. B. Dick Company
- ☐ Falstaff Brewing Corp.
- ☐ Baldwin Locomotive Works
- ☐ Raybestos-Manhattan Co.
- ☐ Sunshine Biscuit Co.
- ☐ Bemis Bros. Bag Co.
- ☐ Scovill Mfg. Co.

Name_____ Address_____

Title_____ City & State_____

"STARTING LOAD ON OUR 40 H. P. CRUSHER MOTOR CAUSED 400 AMP. ORDINARY FUSES TO BLOW . . . BUT NOW 125 AMP. FUSETRON FUSES LET MOTOR START AND GIVE BURNOUT PROTECTION TOO."

Mr. Meeka explains . . .

"We have a crusher driven by a 40 h.p. 250 volt motor. The starting load on this motor is often quite heavy and gave us no end of trouble by causing the 400 ampere fuses protecting the circuit to blow.

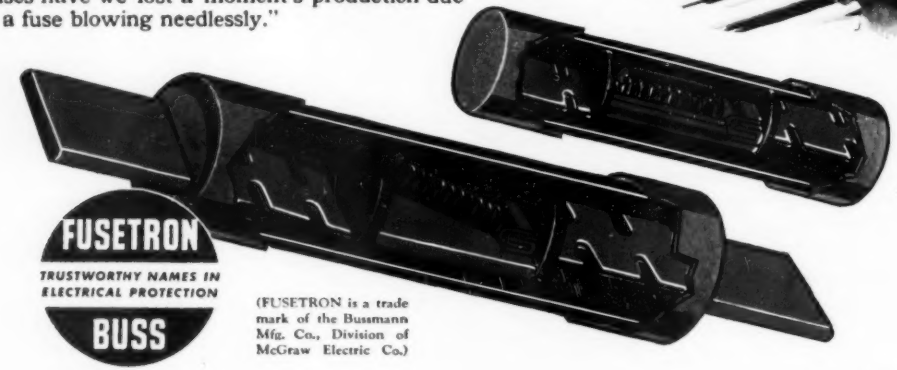
"Some months ago, after checking the actual running current of the motor with an ammeter, we decided to see if FUSETRON dual-element Fuses could live up to their claims.

"The ammeter reading indicated that 125 ampere FUSETRON Fuses should be used to give motor-running protection. So, we installed this size.

"Were we surprised—they not only hold the starting current of the crusher motor—but we have the satisfaction of knowing the motor also has burnout protection to back up the overload relays in case they should ever fail.

"Not once since we installed FUSETRON Fuses have we lost a moment's production due to a fuse blowing needlessly."

ED MEEKA
Supt., ROBINSON BRICK & TILE CO.
Denver, Colorado



FUSETRON
TRUSTWORTHY NAMES IN ELECTRICAL PROTECTION
BUSS

(FUSETRON is a trade mark of the Bussmann Mfg. Co., Division of McGraw Electric Co.)

"FUSETRON FUSES NOT ONLY ELIMINATE USELESS SHUTDOWNS - THEY GIVE YOU 10 POINT PROTECTION."

1 Protect against short-circuits.*

2 Protect against needless blows caused by harmless overloads.

3 Protect against needless blows caused by excessive heating—lesser resistance results in much cooler operation.

4 Provide thermal protection — for panels and switches against damage from heating due to poor contact.

5 Protect motors against burnout from overloading.

6 Protect motors against burnout due to single phasing.

7 Give DOUBLE burnout protection to large motors — without extra cost.

8 Make protection of small motors simple and inexpensive.

9 Protect against waste of space and money — permit use of proper size switches and panels

10 Protect coils, transformers and solenoids against burnout.

*Fusetron Fuses have high interrupting capacity as shown by tests of the Electrical Testing Laboratories of New York City in December 1947.

DON'T RISK LOSSES

One **needless** shutdown . . .
One **lost** motor . . .
One **destroyed** switch or panel
One **burned out** solenoid . . .

May cost you far more than replacing every ordinary fuse with a Fusetron dual-element Fuse.

MAIL THE COUPON NOW for complete information about the All-Purpose Protection of FUSETRON Dual-Element FUSES.

BUSSMANN Mfg. Co. (Division of McGraw Electric Co.)
University at Jefferson, St. Louis 7, Mo.

Please send me complete facts about FUSETRON dual-element Fuses.

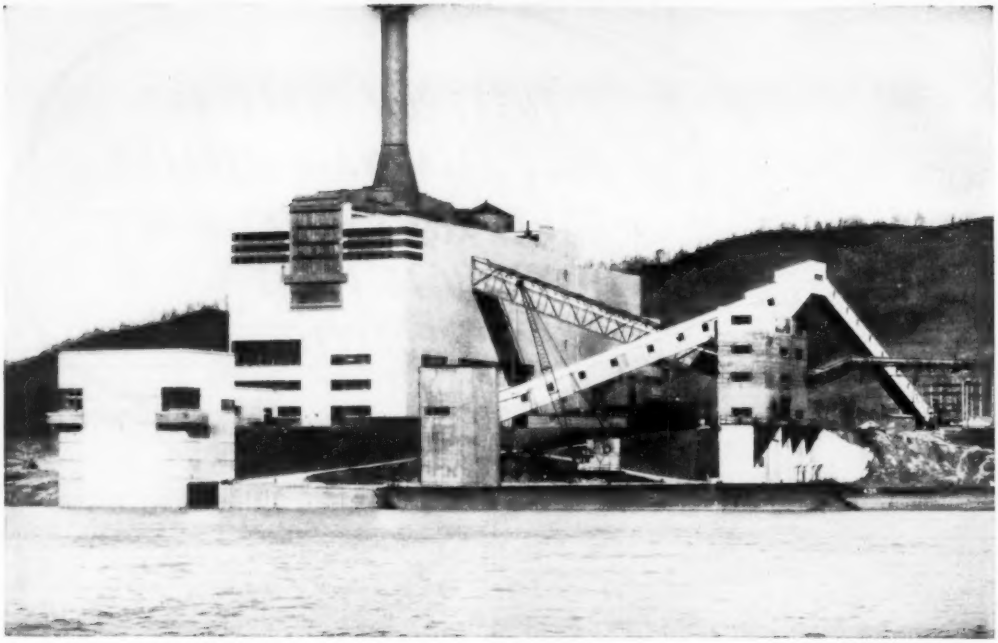
*Name*_____

*Title*_____

*Company*_____

*Address*_____

*City & Zone*_____ *State*_____ 552



Unique Circulating Water System Installed in This Power Plant

The R. E. Burger steam-electric plant of Ohio Edison Company is located on the Ohio River well above flood stage—which may reach as much as 60 feet above extreme low water. Water is supplied to the condensers by a patented circulating water system pioneered jointly by Worthington and the consulting engineer, Mr. George W. Saathoff.

All major equipment except circulating pumps, which are designed to operate completely submerged if necessary, are located above flood stage.

The new installation of a Worthington 70,000 sq ft two-pass condenser and auxiliaries, serving a 90,000 kw turbine-generator, is the third Worthington unit in this station. Two 46,000 sq ft condensers were previously installed.

For advice or information, consult Worthington Corporation, formerly Worthington Pump and Machinery Corporation, Steam Power Division, Harrison, New Jersey.

HOW IT WORKS

Two full-capacity circulating pumps are used in series.* The primary pump, submerged below extreme low water, is a Worthington motor-driven HIFLO. Its high starting head characteristic is able to deliver enough water for starting purposes. A booster pump—a single-suction volute Worthington MIXFLO, mounted directly upon an hydraulic turbine—starts when there is enough water in the control well. The two pumps then operate automatically in series at full capacity.

Advantage is taken of maximum siphon effect from the condenser drop leg which enters the sealing or control well. From this well, all circulating water is passed through the hydraulic turbine. Thus the static head from sealing well to river level is utilized—75-80% being recovered—in reducing the work of the primary pump, with saving in overall pumping power.

The booster pump functions until rising water renders the turbine ineffective. Then the primary HIFLO works alone, producing full capacity under reduced head.

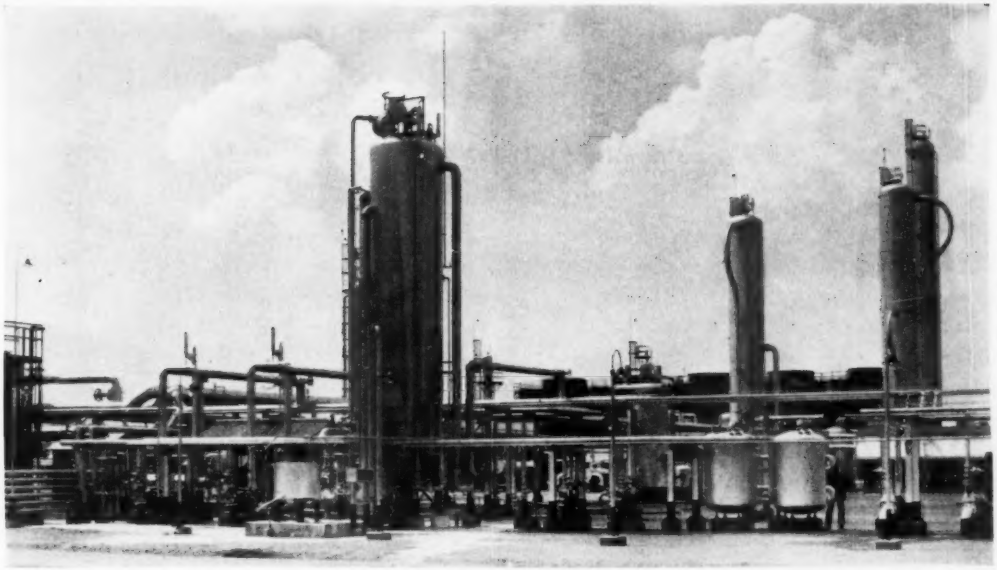
*In the new unit, there are two half-capacity primary pumps, permitting operation of only one in the winter when low water temperatures prevail.

Z.1.1

WORTHINGTON

WORLD'S BROADEST LINE OF STEAM POWER PLANT AUXILIARIES

Feed Water Heaters	Boiler Feed Pumps	Steam Turbines
Steam-Jet Ejectors	Water Treating Equipment	Surface Condensers



NORTH COWDEN GASOLINE PLANT near Odessa, Texas, operated by Stanolind Oil and Gas Company. Here Worthington Water Softeners protect boilers from scale-forming deposits.

Worthington softeners protect this plant's boilers 10 ways

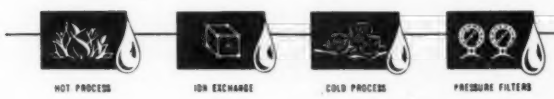
In this case, it's a hot-process softener to remove scale-forming deposits from boiler feedwater.

Let's examine this gasoline plant installation and see how it gives boilers "maximum" protection:

1. *Feed water is softened* by a hot-lime soda system.
2. *Selective deaeration* for operation on make up only, condensate only, or both.
3. *Non-scaling direct-contact vent condenser* heats and vents treated make-up.
4. *Tubular vent condenser vents condensate.*
5. *Oxygen contamination of feedwater avoided* by last-step deaeration.
6. *Stainless steel deaerating elements.*
7. *Uniform and efficient deaeration* during wide load swings.
8. *Filter backwashing* with clean, hot, chemically inert water without velocity change through the softening zone.
9. *Proportionate sludge removal.*
10. *Uniformly proportionate chemical feed.*

Before you buy, investigate Worthington Water Softening Systems thoroughly. Tell us the service conditions, and get our recommendations in terms of dollars and benefits. Write Worthington Corporation, formerly Worthington Pump and Machinery Corporation, Water Treating Section, Harrison, N. J.

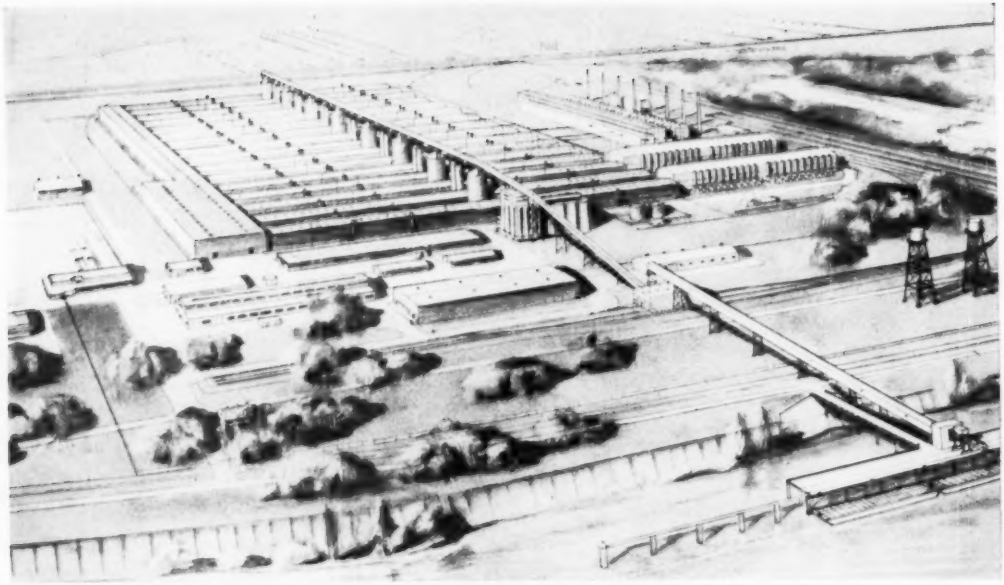
J1.4



Worthington Makes More of the Equipment for ALL Types of Water Conditioning Systems

WORTHINGTON

Water Conditioning



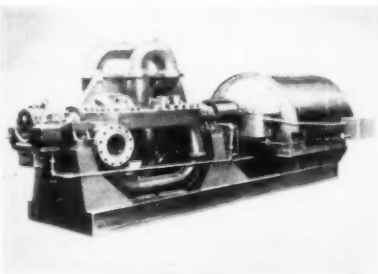
KAISER ALUMINUM AND CHEMICAL CORPORATION'S new 400,000,000 pound-a-year, $150,000,000 aluminum reduction plant at Chalmette, La., designed and built by Kaiser Engineers, is the largest plant of its kind in the U. S. The plant—where production began in December, 1951—uses 19 Worthington boiler-feed pumps and other Worthington equipment including thirty 9,300 square-foot condensers, and fifteen 250,000 pound-per-hour deaerators, 2 steam turbines and numerous circulating pumps.

Power plant at largest aluminum reduction plant to use Worthington pumps, condensers, deaerators

It takes plenty of electric power to produce 400,000,000 pounds of aluminum in a year. And that's what they're doing at the new Kaiser Aluminum plant at Chalmette, La.—largest aluminum reduction plant in the U. S.

Kaiser joins many other top companies in choosing Worthington boiler-feed pumps as well as other key equipment for their new plant. Such choices arise out of an insistence for equipment that's engineered for maximum performance.

Worthington engineering produces boiler-feed pumps of the most advanced design in the field, made from specially selected metals. Each pump is exactly *right* for the pressure and temperature with which it is to perform. Over 110 years of Worthington experience in building pumping equipment go into making this a certainty. Worthington Corporation, formerly Worthington Pump & Machinery Corporation, Centrifugal Pump Division, Harrison, New Jersey. C-2-4



19 WORTHINGTON 250,000 LBS PER HR BOILER-FEED PUMPS at new Kaiser plant, handle feedwater at 257 F against a discharge pressure of 1,030 psig. Pumps are axial-balanced, volute type centrifugals. Two, similar to one illustrated, are driven by Worthington 450-hp steam turbines.

For Boiler Feed Service. Capacities to 1,500 GPM; Heads to 1,000 feet.

For Hotwell, Condensate, Chilled Water Service. Capacities to 1,400 GPM; Heads to 650 feet.

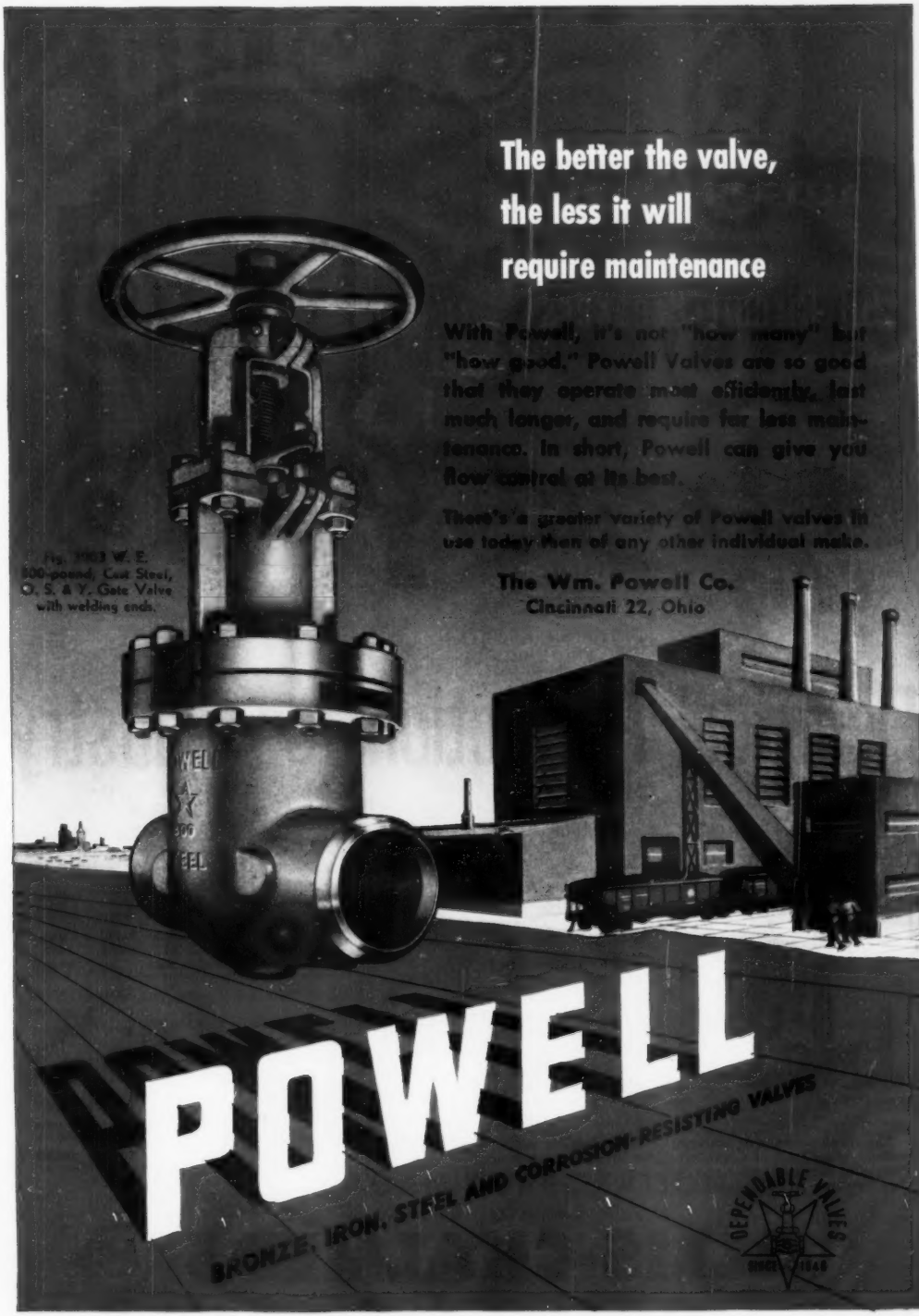
For Water Works, Circulation, Drainage, General Service. Capacities to 135,000 GPM; Heads to 400 feet.

For Boiler Feed Service. Capacities to 3,000 GPM; Heads to 7,000 feet.

WORTHINGTON

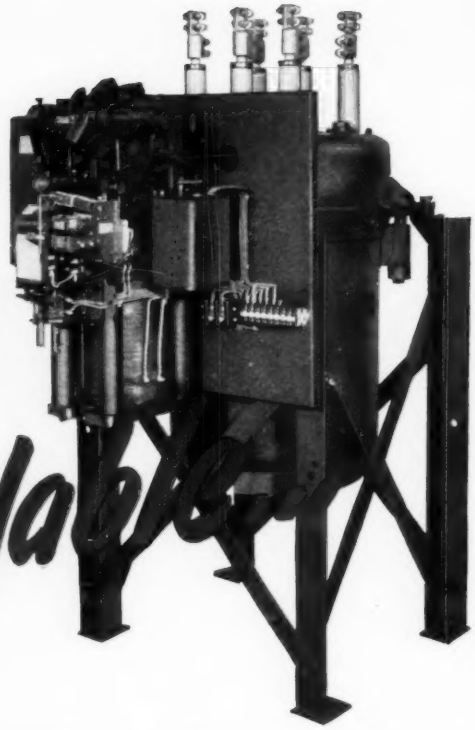
Centrifugal Pumps

The World's Broadest Line Assures You the Right Pump for Every Job


The better the valve,
the less it will
require maintenance
With Powell, it's not "how many" but "how good." Powell Valves are so good that they operate most efficiently, last much longer, and require far less maintenance. In short, Powell can give you flow control at its best.
There's a greater variety of Powell valves in use today than of any other individual make.
The Wm. Powell Co.
Cincinnati 22, Ohio
Fig. 1163 W. E. 600-pound, Cast Steel, O. S. & Y. Gate Valve with welding ends.
POWELL
BRONZE, IRON, STEEL AND CORROSION-RESISTING VALVES
DEPENDABLE VALVES
SINCE 1846

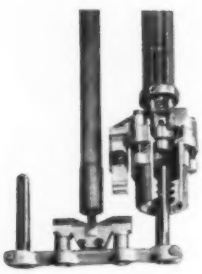
ALLIS-CHALMERS

INDUSTRIAL
Oil Circuit Breakers



Dependable

Electrical Protection for Industry



YOU CAN GET full electrical protection for equipment in your plant with the 8-cycle DZ oil circuit breaker. It is liberally and compactly designed to meet your requirements economically.

Mechanically and electrically trip-free, it combines reliability in operation with the advantages of the single break *Ruptor* interrupting device.

The DZ comes in a wide range of ratings. Mounting with framework or for cubicle, solenoid or manual closing, standard operating voltages, all in accordance with ASA standards.

For more information, see your nearby A-C sales office. Or write Allis-Chalmers, Milwaukee 1, Wis. for bulletins 71B6129D (DZ-60B, DZ-100B, DZ-200B) and 71B6179C. (DZ-40B) A-3381

Ruptor is an Allis-Chalmers trademark.

TYPE	RATED K.V.	MINIMUM KV AT RATED KVA	RATED AMPS.	KVA INT. CAPACITY
DZ-40B	7.2	2.3	600	100,000
			1200	100,000
			2000	100,000
DZ-60B	13.8	4.0	600	150,000
			1200	150,000
DZ-100B	13.8	4.0	1200	250,000
DZ-200B	13.8	6.6	1200	500,000
			2000	500,000

The circuit interrupting efficiency of the *Ruptor* arc interrupting device is the result of simple, yet highly effective contact structure. Its effectiveness is proved over many years of service in these and larger power oil circuit breakers.

ALLIS-CHALMERS

sometimes, only the *best* is good enough!

IF a parachute or a combustion control system doesn't work just right—the user is in for a loss.

A boiler burns millions of dollars worth of fuel during its service-life. A combustion control system which wastes as little as one per cent of this fuel will cost you many thousands of dollars—even five, six, or seven times what the control system itself cost.

That is why only the best combustion control system is good enough. Hagan Combustion Control Systems utilize your fuel accurately, automatically, economically, dependably.

Hagan Corporation's engineers have extensive experience with all types of combustion control applications—a prime reason for their position of leadership. For more information *write, wire or phone*—

HAGAN HALL BUROMIN CALGON

HAGAN CORPORATION

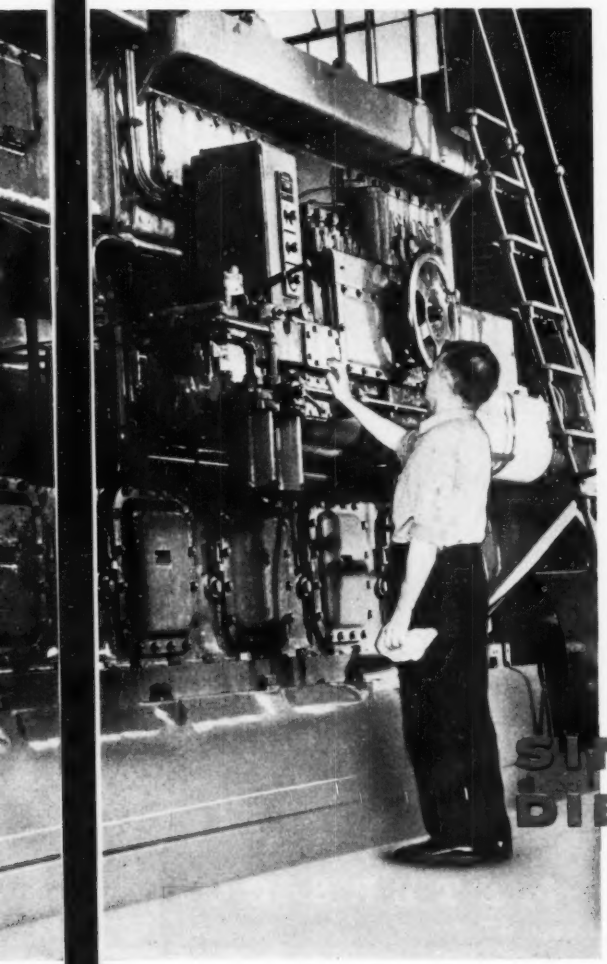
HAGAN BUILDING, PITTSBURGH 30, PA.

BOILER COMBUSTION CONTROL SYSTEMS
RING BALANCE FLOW AND PRESSURE INSTRUMENTS
METALLURGICAL FURNACE CONTROL SYSTEMS
THRUSTORQ FORCE MEASURING DEVICES

Light Plant Solves of Sticking and

Says
Mr. Burgin,
Superintendent of
the Geneseo Municipal
Utilities: "Sinclair
GASCON has given us
less varnish, less
piston sticking, and a
cleaner engine."

Problems Rings Carbon Build-Up!



For quite some time the Light Plant of Geneseo Municipal Utilities, Geneseo, Ill., had trouble with sticking rings, and with carbon deposits in the exhaust ports of its diesels. A few years ago these diesels were changed over to Sinclair GASCON D. Almost at once, it was noted that the troublesome conditions started to clear up. In the time since, sticking rings have become the rare exception and the carbon deposits are no longer a problem.

Furthermore, in 1947, a 1400 hp. Fairbanks-Morse engine, shown at left, was installed and filled with GASCON D. This engine has never had a sticking ring and is running remarkably clean, with exceptionally low cylinder wear.

Perhaps GASCON® Oil can cure *your* diesel troubles, too. Get in touch with your nearest Sinclair Representative or write Sinclair Refining Company, 600 Fifth Ave., New York 20, N. Y.

SINCLAIR DIESEL OILS

prolong engine life

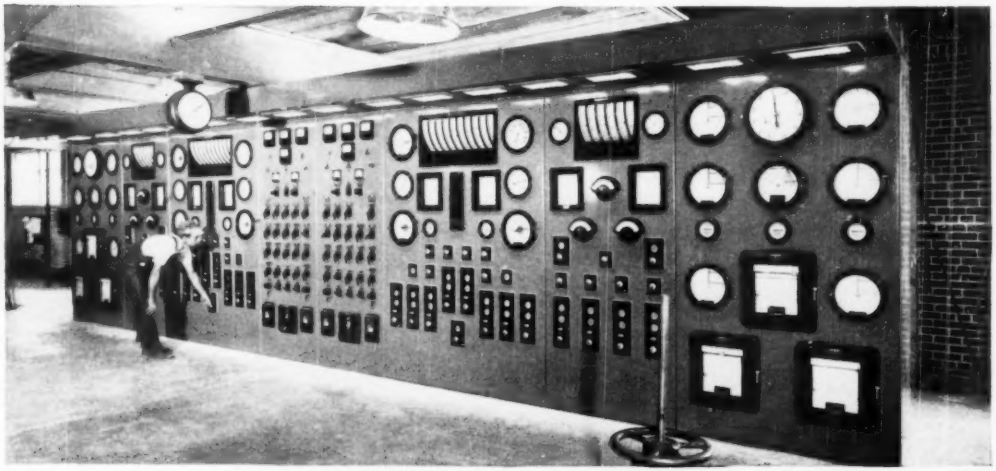
REPUBLIC

Combustion Control Systems

AN automatic combustion control system, as designed and built by Republic, will enable you to operate your boiler (or boilers) over a long period at test efficiencies regardless of variations in fuel, load and other operating factors.

Republic combustion control is a unified system controlling the fuel and air supply to the boiler in the correct amount to maintain constant steam pressure and in the correct ratio to maintain maximum combustion efficiency.

Republic automatic combustion control systems, either pneumatic or hydraulic, are available for all sizes of boilers, all types of fuel firing, and load conditions and any arrangement of draft equipment. They are completely described in Data Book No. S-21—write for your copy.



PULVERIZED COAL
In this modern central station steam is generated in two 600,000 lbs. per hr. pulverized coal fired boilers operated by a Republic Combustion Control System.

REPUBLIC FLOW METERS CO.
2240 Diversey Parkway, Chicago 47, Illinois

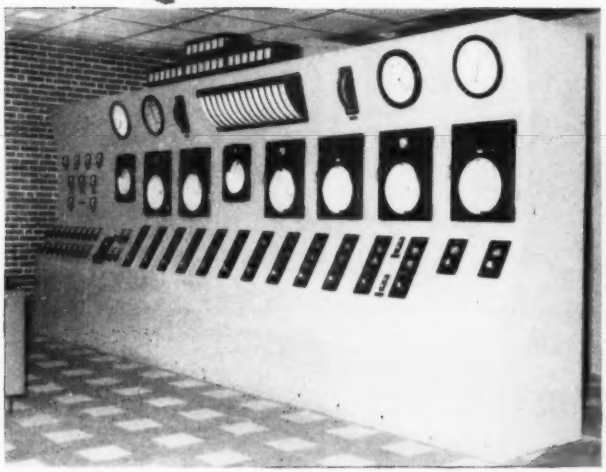
for

All Sizes of Boilers

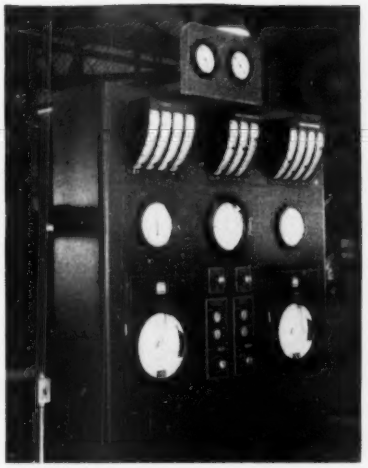
All Types of Firing

All Arrangements of Draft

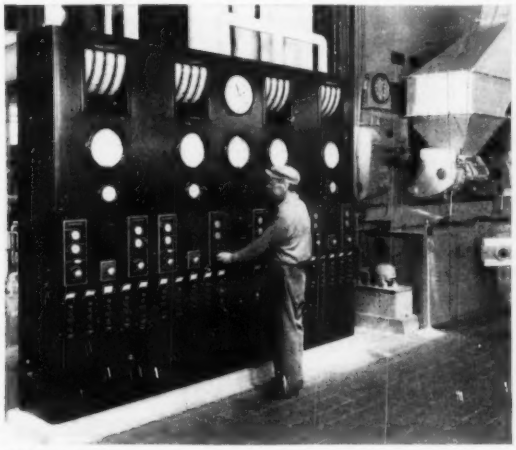
All Load Conditions



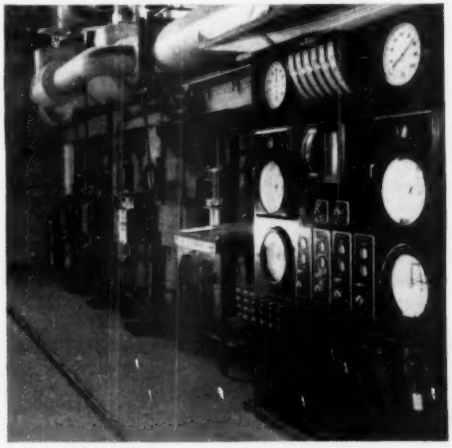
OIL FIRED
A typical Republic automatic boiler control and instrument installation in a large central station for the operation of a 450,000 lb. per hr. oil fired boiler.



MIXED GAS
Republic instrument and controls for two 50,000 lb. per hr. boilers burning mixed gas.



STOKER FIRED
The Republic combustion control and instrument panel for the automatic operation of four 80,000 lb. per hr. stoker fired boilers.



STOKER FIRED
In this modern industrial plant steam is generated in a 175,000 lb. per hr. stoker fired boiler operated by a Republic control system.

"I wonder what happened to me !" said Alice

ALICE in Wonderland ate the magic cake and grew until she was more than nine feet tall. Our National bureaucracy also seems to have partaken of the magic cake of power. Bureaus in our government have grown in number and scope until their activities now control, to a great extent, the lives of all individual Americans. Department after department adds more and more people -- state, justice, commerce, treasury -- not to mention those sprawling emergency born agencies of price control, N.P.A. and other alphabetical subdivisions.

The number of employees of our federal, state and local governments continues to grow. During many recent months, personnel was added to the federal payroll at the rate of 1,500 daily.

What is the reason for this mushrooming? The Korean War? Threat of war in Europe, Southeast Asia, or the Middle East? Obviously not! A glance at the federal budget gives the answer. The estimated cost of all governmental functions for the fiscal year 1952 is in excess of 70 billions of dollars, an increase of 26 billions, or approximately 60% more than last year.

When will it end? Only you, the individual citizen, who carries the bureaucratic load on his back, can stop it. It will end when enough patriotic men and women demand from congress that the Washington Wonderland start shrinking back to reasonable proportions.

YOUR SCRAP IS NEEDED — YOUNGSTOWN

The Youngstown Sheet and Tube Company

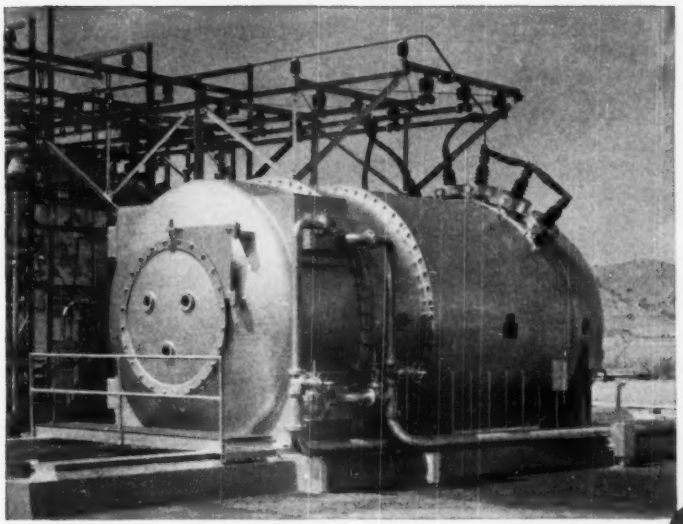
General Offices -- Youngstown 1, Ohio

Export Offices -- 500 Fifth Avenue, New York

MANUFACTURERS OF CARBON ALLOY AND YOLOY STEELS

The steel industry is using all its resources to produce more steel, but it needs your help and needs it now. Turn in your scrap, through your regular sources, at the earliest possible moment.

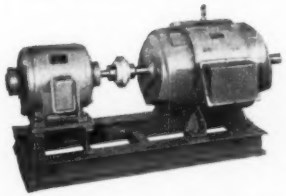
Synchronous Condensers do a GOOD JOB



BETTER with REGULEX CONTROL

WHEN *REGULEX* regulators guard synchronous condensers from excessive overload and pole slipping, they assure the best possible job of line voltage regulation. That's why this 40,000/16,800 kva condenser, supplying reactive kva to stabilize a long transmission line, is equipped with *Regulex* control. Even under adverse conditions it's kept on the line . . . automatically supplying the maximum safe amount of corrective kva. A-3676

Regulex Control is Accurate . . . Simple to Adjust and Maintain



THE MOTOR-DRIVEN *Regulex* exciter is conservatively rated for long life. Since it's similar in construction to a dc generator, the same periodic inspection routine can be followed. No special training of maintenance personnel is required.

ONLY THREE operating controls needed: (1) a control switch places regulator in and out of service; (2) a second switch controls the motor-operated main exciter field rheostat; (3) a voltage adjusting device selects proper ac regulated voltage.

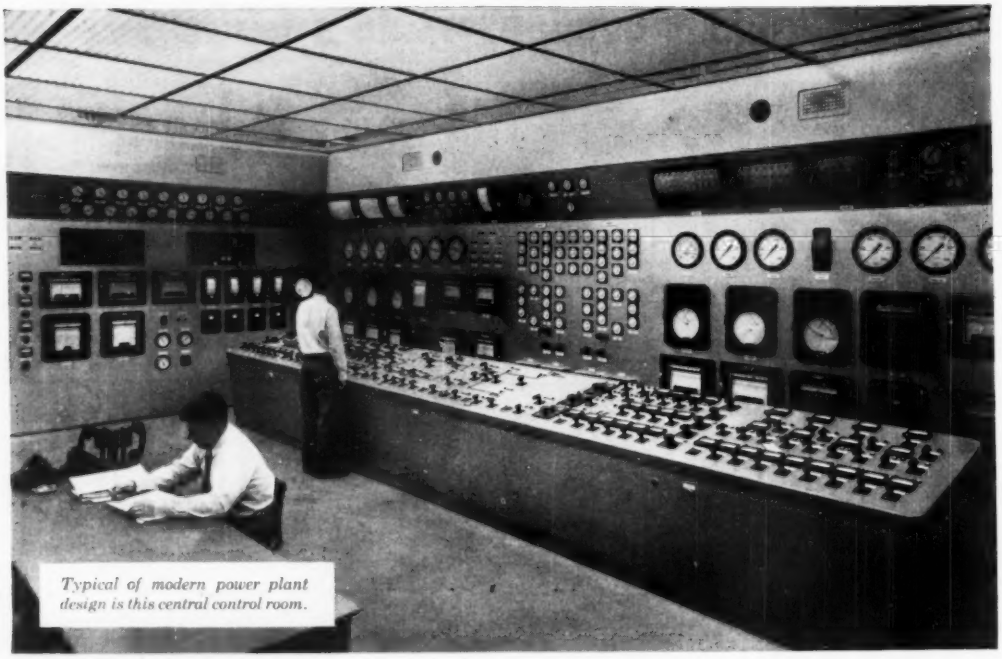
COMPONENTS of the *Regulex* voltage regulator in this cabinet have no moving parts, require no maintenance or adjustment after installation. This single control cubicle can be placed in any convenient spot or combined with switchgear equipment.

★ You can use *Regulex* voltage regulators on alternators, synchronous condensers, and large synchronous motors. In every application, *Regulex* control gives fast response, provides accurate, sensitive voltage control. See your A-C representative or write Allis-Chalmers, Milwaukee 1, Wisconsin.

Regulex is an Allis-Chalmers trademark.

A-C ALLIS-CHALMERS

ALLIS-CHALMERS



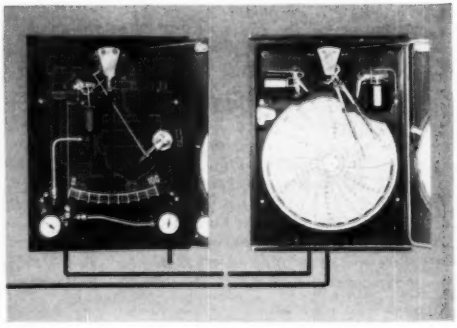
Typical of modern power plant design is this central control room.

For centralized

look to Honeywell for pressure, level and

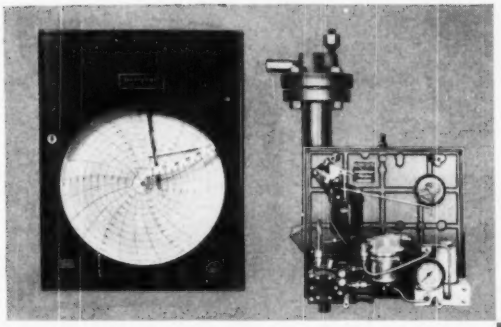
remote pressure measurement

By using Brown transmission systems, pressure measurements can be recorded in the operating control board without any high pressure piping going to the control panel . . . thus simplifying supervisory panel construction, reducing panel cost and improving safety to operators. Connections to the panelboard carry only low pressure instrument air. Brown sensing elements cover a variety of ranges from superheat and oil pressures to condenser vacuum.



Prompt Service . . . from Coast to Coast

Wherever you may be, you'll find one of the more than 80 Honeywell offices convenient to you . . . ready to give quick, on-the-spot service. You can get a factory-trained service engineer when you need him . . . often in a matter of hours . . . just by calling the Honeywell office nearest you.

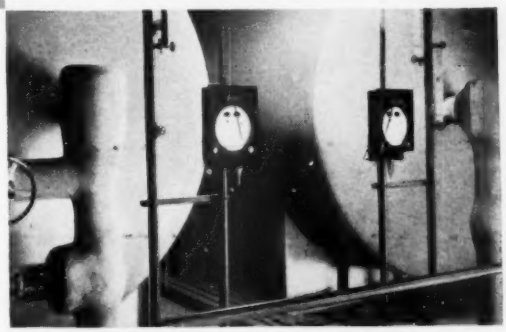


remote flow measurement

Flow of boiler steam, auxiliary steam, feedwater and other critical parts of the heat cycle is readily measured and transmitted to the control room by Brown instruments. Systems can be either the square root type (electric or pneumatic transmission) or evenly graduated type (electric transmission) . . . the latter ideally suited to flow cost accounting. Its evenly graduated scale permits full readability at all flow rates . . . eliminates inconvenience of crowded divisions at low range. Electronic integration is fast and precise; features simplified, maintenance-cutting design.

remote liquid level measurement

Brown pneumatic-transmitting instruments keep operators informed of the level of liquid in condensate storage tanks, hot wells, boiler drums and other locations remote from the control room. Measuring systems are supplied for open tanks, for closed vessels which operate under pressure, for corrosive liquids, and liquids containing suspended solids.



instrumentation . . .

flow measurement (and transmission)

EFFECTIVE utilization of centralized supervisory instrumentation for power plants places a premium on the accuracy and dependability of remote measurements and transmissions.

You can count on Brown flow, pressure and liquid level instruments to deliver the performance you need. Using pneumatic transmission, they accurately relay information from the metering point to receiving instruments in operating areas and in central control room . . . operating at full responsiveness over distances of several hundred feet.

At the transmitting end, an appropriate sensing element detects the measured variable, and a pneumatic transmitter produces a low pressure output varying in proportion. A small diameter air line conveys this pressure to remote recording instruments on the central control board and indicators on the local control boards.

Matched construction and characteristics of the transmitter and receiver assure top accuracy. Rugged design keeps calibration constant at both ends of the system.

Widely used in hundreds of industrial plants, Brown pneumatic transmission systems are available in every range needed for power plants. Electric transmission systems, for these same variables, can also be supplied when preferred. Your local Honeywell engineer will be glad to discuss your specific applications. Call him today . . . he is as near as your phone.

MINNEAPOLIS-HONEYWELL REGULATOR CO., *Industrial Division*, 4490 Wayne Ave., Philadelphia 44, Pa.

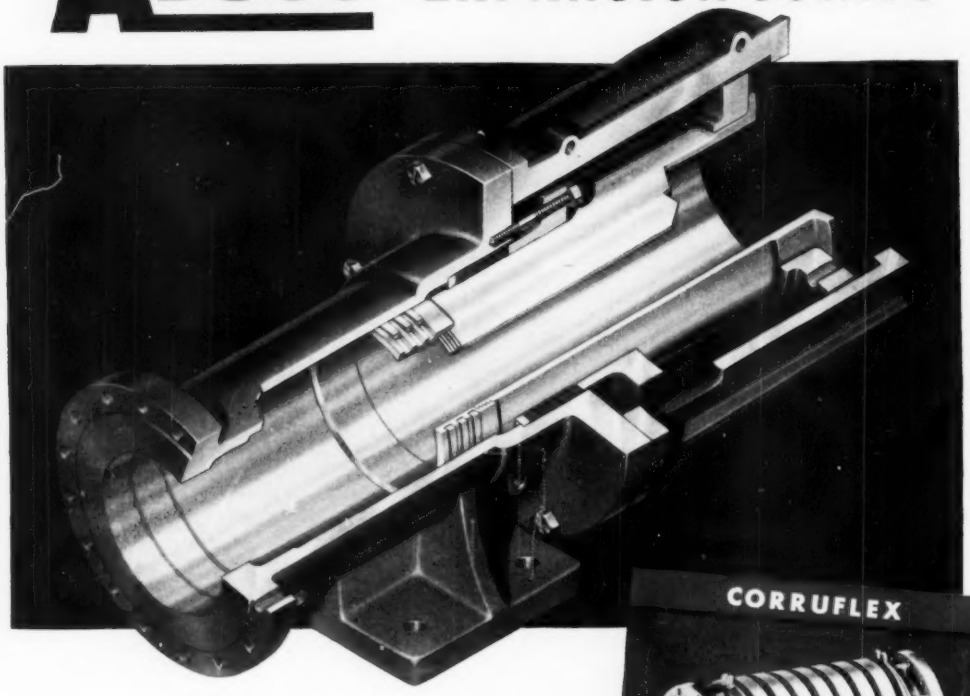
MINNEAPOLIS
Honeywell
BROWN INSTRUMENTS

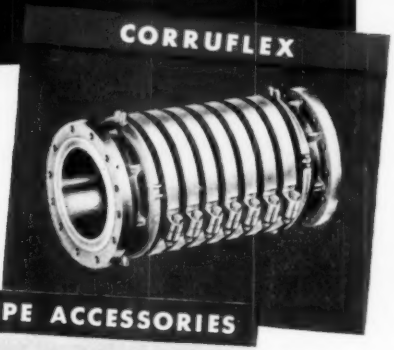
First in Controls

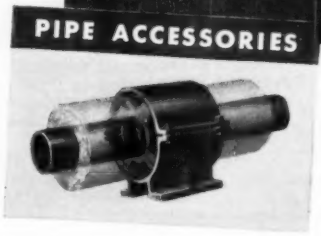
● *Important Reference Data*

Write for Catalog 90-2, "Supervisory Instruments for Power Generation" and Instrument Data Sheet No. 9.1-4, "Pneumatic Transmission Improves Safety."

ADSCO EXPANSION JOINTS







ADSCO'S piston-ring expansion joints can be serviced *and* packed under full-line pressure. That's why they're best. Simple and compact, they will absorb expansion caused by temperature differential in pipes carrying liquids, gases, or steam. The high-polish surfaces of these joints can never be scored, because the slips are in contact only with packing. Misalignment is prevented by both internal and external guiding. Write for Bulletin 35-15G. Remember, only ADSCO makes all types of expansion joints. We don't have to sell what you don't want to buy.

ADSCO
75 YEARS OF LEADERSHIP

AMERICAN DISTRICT STEAM COMPANY, INC.
NORTH TONAWANDA, NEW YORK

Operating Cost Savings

ENGINEERED INTO PIPING BY *NAVCO*

Careful and expert preliminary engineering work by Navco Engineers, in addition to employing the most modern fabricating and erection methods, are your guarantee of operating savings.

Consult Navco for just a Pipe Bend, or a complete Piping System.

- ★ Assured Safety
- ★ Efficient Operation
- ★ Minimum Fuel Costs
- ★ Low Maintenance
- ★ Long Trouble-Free Life

NAVCO

NAVCO PIPING

NATIONAL VALVE & MANUFACTURING COMPANY • PITTSBURGH, PA.

NEW YORK • CHICAGO • CLEVELAND • BOSTON • ATLANTA • TULSA • BUFFALO • CINCINNATI

Actual size

Look behind this new Taylor Dial

and you will see an all-new movement design that gives greater accuracy, greater flexibility of adjustment, and greater convenience for temperature, pressure and load applications.

FOR TEMPERATURE, mercury actuation uses a new Bourdon spring that gives greater accuracy and sensitivity and 100% over-range protection, short range spans, and smaller bulbs for installation convenience. Available also with gas, organic liquid (Monolex) or vapor actuation to fit every temperature requirement within the limits of $-100°$ to $+1200°$ F.

FOR PRESSURE, there are range spans from 12 psi to 20,000 psi, Bourdon springs or C springs in a variety of metals to fit required services. Standard thin diaphragm volumetric pressure systems can also be used.

FOR LOAD, a new mercury Bourdon spring has been developed for highest accuracy with Taylor tension and compression load elements.

THE NEW CASE is made of die-cast aluminum, can be face or flush mounted, is fume and moisture proof. Special pointer permits easy, accurate zero settings. Take your choice of double-strength sheet glass, shatterproof glass or anti glare glass. Ask your Taylor Field Engineer, or write for **Bulletin 98214.** Taylor Instrument Companies, Rochester, N. Y., and Toronto, Canada.

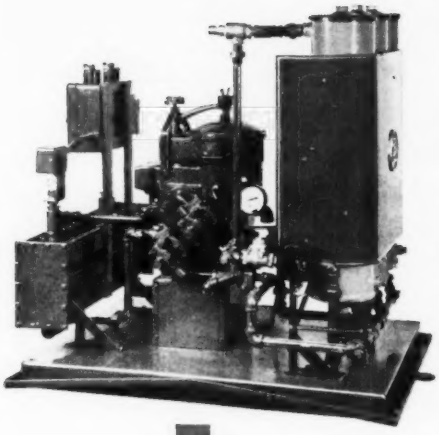
▼ ▼ ▼

Instruments for indicating, recording and controlling temperature, pressure, flow, liquid level, speed, density, load and humidity.

TAYLOR INSTRUMENTS MEAN ACCURACY FIRST

IF WATER RUINED YOUR OIL

WHAT WOULD YOU LOSE BESIDES OIL?



If your turbine ever developed a sudden water leak, and you own a De Laval centrifugal purifier, you would be completely safe. The De Laval would promptly remove the undesirable water, and no damage would be done to your turbine.

No other means of purifying oil offers the same ***complete*** protection as a De Laval centrifuge. Wholly mechanical in operation, it continuously separates and discharges every bit of moisture, whether it is only a few drops of condensate or "sudden trouble" water in quantity. The De Laval also, of course, separates out all solid contaminants that might get into the oil.

A De Laval Oil Purifier, therefore, is the last word in turbine oil purification, as it gets rid of ***both*** troublemakers.

Why take a chance on contamination, when it is so easy to be ***safe*** and ***sure*** with a ***De Laval***.

THE DE LAVAL SEPARATOR COMPANY
Poughkeepsie, New York 427 Randolph St., Chicago 6
DE LAVAL PACIFIC CO., 61 Beale St., San Francisco 5
THE DE LAVAL COMPANY, Limited, Peterborough, Ont.

De Laval OIL PURIFIERS

FOR DIESEL LUBRICATING OIL

Here's another reason why the 'Specs' call for "WELDOLETS"

Extra strong WeldOlets, butt-welding, utilized to make fully reinforced branch connections in Gas Measurement Headers to operate at 1000 psi.

LET'S COMPARE THE PLUS FEATURES OF WELDOLETS AGAINST REINFORCING RINGS OR PADS

1. The WeldOlet is a Welding Fitting rather than a hand-made reinforcement of a hand-made joint. It is both a mechanical and a pressure member.

2. The self-aligning, shaped and beveled WeldOlet is equally adaptable for shop or field fabrication. Its employment eliminates the need for additional reinforcement.
3. Production economy is realized by employment of WeldOlet construction which speeds up installation time in both shop and field fabrication. Only two welds are required to install WeldOlets.
4. The WeldOlet type of construction inherently provides sufficient reinforcement in accordance with Code requirements to meet or surpass the maximum services of whatever weight pipe is used. To facilitate determination of where it is necessary to reinforce or to use a WeldOlet, the new Bonney catalog W-3 features time-saving data on this subject.
5. Dimensional advantages of WeldOlets allow closer manifolding and cross combinations and provide improved flow conditions.

1. Precious pipe is wasted in making reinforcing rings or pads.

2. Reinforcing rings can be cumbersome to handle and clumsy to fit in both shop and field fabrication.
3. Excessive welding is necessary to complete branch reinforcing requirements according to Code provisions when rings or pads are used. Three separate welds are required. This slows down piece production time in both shop and field fabrication.
4. Lengthy calculations are necessary to determine the amount of reinforcing required when designing for ring or pad reinforcement.

The Bonney Catalog No. W-3 will show you why WeldOlet Welding Fittings offer the quickest, safest and most economical method of establishing and maintaining 100% pipe strength at branch connections in accordance with Code provisions. Write for your free copy.

CANADIAN REPRESENTATIVE
Sterling Steel Co., Ltd.
267 Davenport Road
Toronto 1, Canada

EXPORT DISTRIBUTOR
National Supply Co. Export Div.
600 Fifth Ave., New York 20, N.Y.

WELDING FITTINGS DIVISION
BONNEY FORGE & TOOL WORKS
550 GREEN STREET, ALLENTOWN, PENNSYLVANIA

How to Be Prosperous

IN OUR OPINION, James F Lincoln, president of Lincoln Electric Co, has the right idea. Last year the men in his Cleveland plant averaged $7800 each in wages and bonus. Lincoln didn't pull all this money out of the air or some philanthropic fund. Neither did he take it from customers or stockholders. It came directly from high production, guided by progressive management and inspired by highly attractive dollar incentives.

Over a period of 17 years such methods and incentives have cut Lincoln's man-hours per unit of product by 85%. What once took a man 100 hours now takes 15.

Lincoln's highly successful management methods are described in his latest book, *Incentive Management*, a book that should inspire thousands of ambitious workers and managers.

Perhaps there are still other ways to give all concerned an incentive to produce more of the things that make up a high standard of living. Whatever the method, let's never lose sight of this fundamental: The general prosperity level of the working people of the U.S. in the years to come will be determined by the volume of national production. This volume of national production, in turn, will be determined by how intelligently the skill of workers and managers is teamed with machines and power to turn out more goods.

It's as simple as that, yet many otherwise sensible people will keep on chasing rainbows while overlooking the open road to wealth for all—production.

Take the matter of profits. Many people feel that business profits are too high and that something ought to be done about it. National opinion surveys show that the ordinary citizen thinks about 25c of the average sales dollar is profit. He figures 10c on the dollar would be fair, and he would like to siphon off the "excess" 15c to bolster the budgets of working people.

Here is an outstanding example of dangerous conclusions based on wrong information. How wrong? According to undisputed government statistics the average business profit in the U.S., even in these prosperous times, is 4 to 6c per sales dollar. There isn't anything left to siphon off unless we propose to wreck the whole economy for an extra penny or two.

It should be obvious that production and prosperity go hand in hand, but the fact is often overlooked while people chase rainbows. So let's take another look at the fundamentals: Leaving out the secondary effects of exports and imports, the national prosperity picture looks something like this: Our people work in mining, farming, manufacturing, transportation and service industries to produce and deliver necessities, comforts and luxuries for immediate use—plus capital goods (machines, factories, power plants, etc) that will help them turn out still more useful things in the future.

Since relatively little can be stored in warehouses, the national consumption of goods and services, over a period of years, must equal the amount produced. The only possible conclusion is that the average standard of living is merely this yearly total production of useful things divided by 150,000,000 (the U.S. population).

The first interest of working people as a group is to get the lion's share of this total production. That's what they are already getting—65% according to government statistics for 1951. The only remaining road to their greater prosperity is through increasing the national production. To put it another way, there's no chance for the worker to get a much bigger slice of the national-income pie because he's got most of it already.

But there is an almost unlimited opportunity for him to profit by helping make a bigger pie—a bigger total produced from which he may claim his share.

This increased production will come about naturally where those men and women who do the most to make it possible get their immediate rewards without waiting for millions of others to catch up with them. In short, as James Lincoln proves, individual incentive is just as essential for workers as it is for owners and managers.

Again it's Edward Valves in over

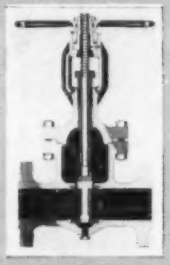
THE EVIDENCE: **456 out of 476 (95.8%) of new central station and municipal power plant projects scheduled to start operation in 1952 or earlier use EDWARD steel valves.**

(Source—1948, 1949, 1950 and 1952 McGraw-Hill surveys of central station and municipal power plant installations. None published in 1931.)

TYPICAL EDWARD DESIGNS GOING INTO NEW STATIONS

Cast Steel Non-Return

Cast Steel Stop


Cast Steel Gate

Cast Steel Check

Forged Gage

Forged Stop

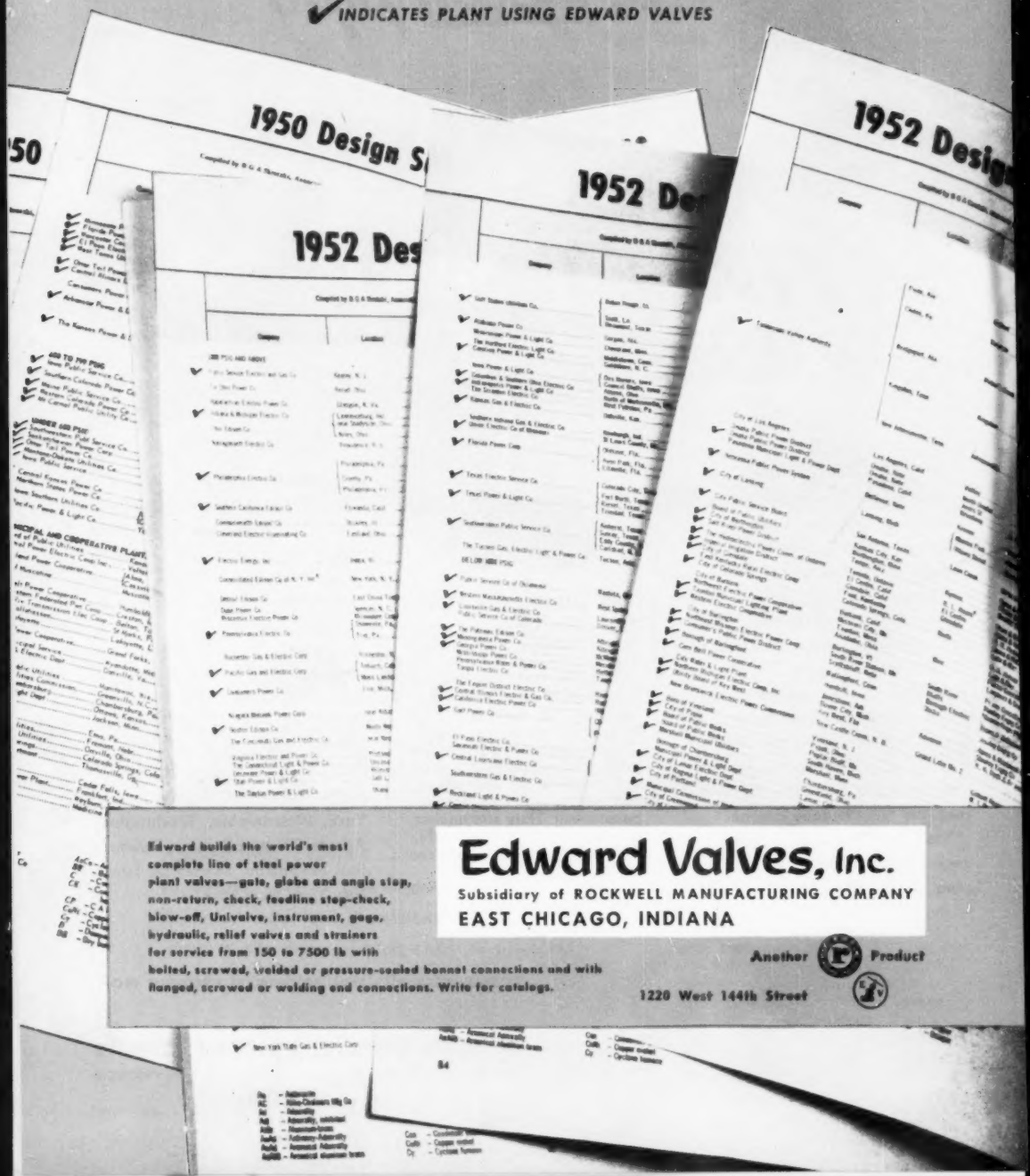
Blow-off

Forged Instrument

Forged Univalves

95% of new power plant projects

✔ INDICATES PLANT USING EDWARD VALVES



Edward builds the world's most complete line of steel power plant valves—gate, globe and angle stop, non-return, check, feedline stop-check, blow-off, Univalve, instrument, gage, hydraulic, relief valves and strainers for service from 150 to 7500 lb with bolted, screwed, welded or pressure-sealed bonnet connections and with flanged, screwed or welding end connections. Write for catalogs.

Edward Valves, Inc.

Subsidiary of ROCKWELL MANUFACTURING COMPANY

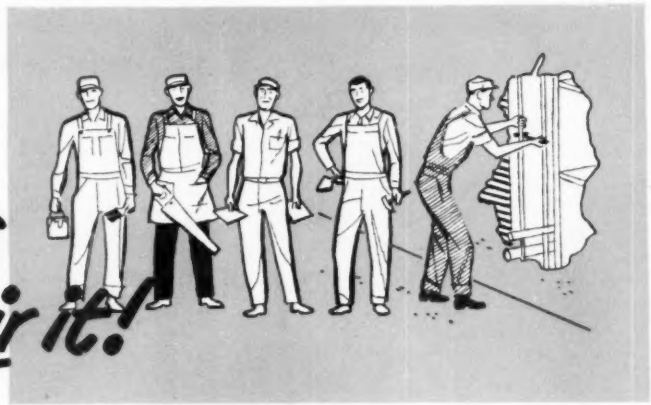
EAST CHICAGO, INDIANA

Another Product

1220 West 144th Street

IT TAKES ONLY ONE

to install pipe



but FIVE to repair it!

One of the most convincing demonstrations on the economy of using *durable* material is a repair job where low-first-cost material has failed—and is being replaced.

The original installation had been quickly made by pipe fitters. But the replacement calls for hours of work by as many as five crafts: pipe fitter, mason, plasterer, carpenter, painter. And this is only part of the cost story. The loss in production or utilization during the shut-down may amount to far more than the maintenance charge.

True, you pay a little more to *begin* with for Byers Wrought Iron pipe . . . but you pay a lot less to *end* with. In literally thousands of applications where corrosion costs you more than wrought iron, the use of this material is the soundest kind of economy move.

WHY WROUGHT IRON LASTS

This notch-fracture test specimen illustrates the unusual fibrous structure of wrought iron—which is responsible for the unusual corrosion resistance of the material. Tiny threads of glass-like silicate slag, distributed through the body of high-purity iron, halt and disperse corrosive attack, and discourage pitting and penetration. They also anchor the initial protective scale, which shields the underlying metal.

You will find a lot of helpful information on the control of excessive maintenance through the use of Byers Wrought Iron pipe in our technical bulletin, WROUGHT IRON FOR PIPING SYSTEMS. We will be glad to send you a copy.

A. M. Byers Company, Pittsburgh, Pa. Established 1864. Boston, New York, Philadelphia, Washington, Atlanta, Chicago, St. Louis, Houston, San Francisco, Export Division: New York, New York.

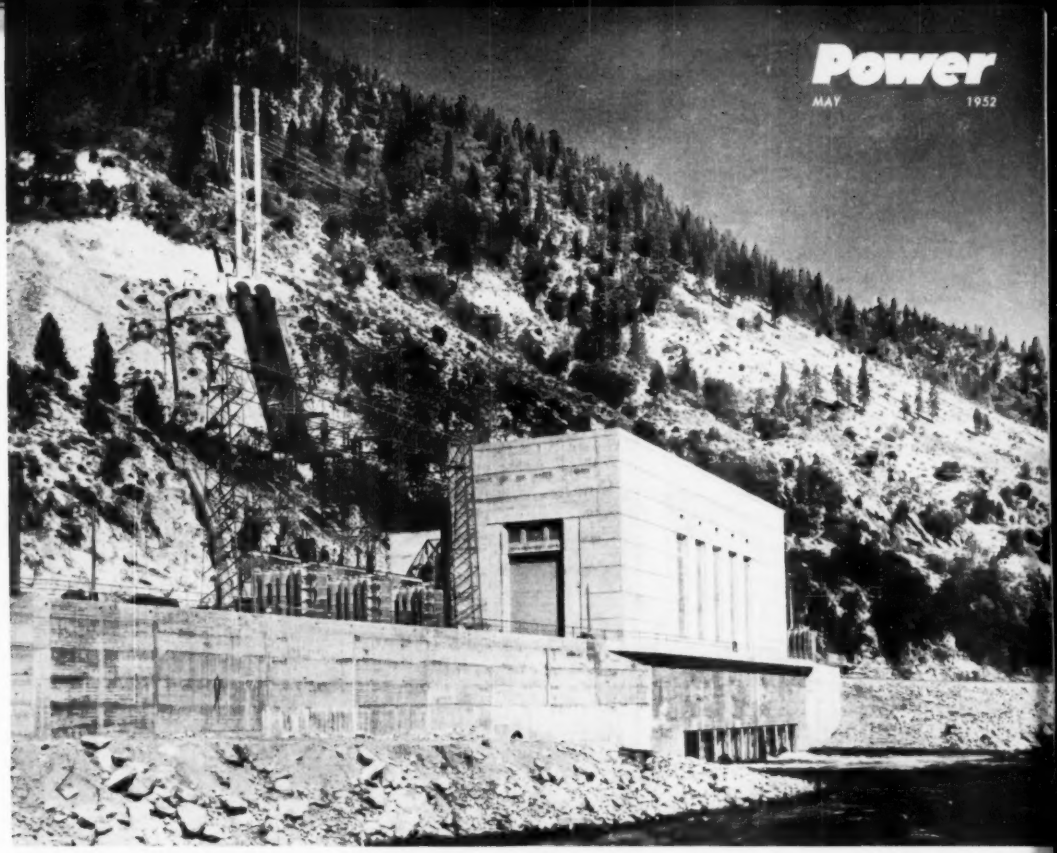
BYERS

CORROSION COSTS YOU MORE THAN WROUGHT IRON

WROUGHT IRON

TUBULAR AND HOT ROLLED PRODUCTS

ELECTRIC FURNACE QUALITY ALLOY AND STAINLESS STEEL PRODUCTS



RATED AT 147,000 HP, Rock Creek design enabled taking advantage of greater capability from lower water head losses and liberal hydraulic turbine design. Two francis turbines each drive 63,000-kva 0.9-pf alternating-current generators

Rock Creek Hydro Plant Steps Up River Output

Another river in rugged Sierra Nevada is made to develop its full power-producing abilities. Crowded conditions of railroad, highway and plant at site demand high order of engineering analysis of hydraulic design and economics

By **ELMER F MARYATT,** *Div of Hydroelectric & Transmission Engrg, Pacific Gas and Electric Company*

► The North Fork of Feather River offers one of those rare possibilities of continuous power development throughout its entire course in the mountains of California. From the stored waters in Lake Almanor (4500 ft) to the river below Big Bend Power House, the North Fork drops about 4000 ft. Horizontal distance of about 300,000 ft gives an average grade of 1.33%, all of which can be developed for power generation.

Throughout the ages the river has dug a deep, narrow canyon, the walls providing tunnel locations, even with a choice of routings. Canyon depth can be best appreciated at Bucks Creek Power House where entire length of penstock may be seen from one position. Static head equals 2561 ft.

Rock Creek. Width of canyon at the water's edge in the development averages around 150 ft. Walls of granite slope back in varying degrees of steepness. A flat area of right size and location for a powerhouse site is hard to find. Western Pacific Railroad and the

State Feather River Highway also occupy the canyon here. These two facilities and the powerhouse all stand on the same side of the river. Only through careful analysis of available space could requirements of all be satisfied.

Each foot the powerhouse encroached into the river decreased the channel cross section and automatically increased elevation of flood stages. Each foot in the opposite direction forced the highway further into the mountain, increased the retaining-wall problem for supporting the railroad fill.

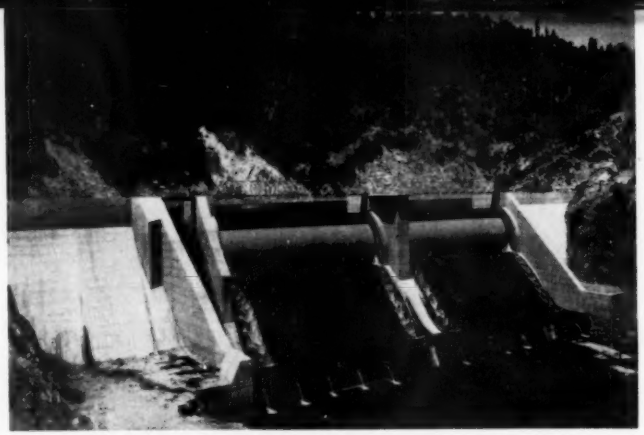
Because of the extreme limitation of available space the powerhouse building was designed for minimum width. This was done by selecting generators with the least over-all diameter and by designing the switchboard and its room to a minimum depth by increasing its length. Additional space was saved by using two transformer banks instead of one, and by placing the two banks at the ends of the powerhouse, one upstream, the other downstream. This needed increased lengths of metal-enclosed bus, which at about $300 per ft was no small item.

Provisions had to be made for transporting the spare transformer through the generator room so it could serve either bank.

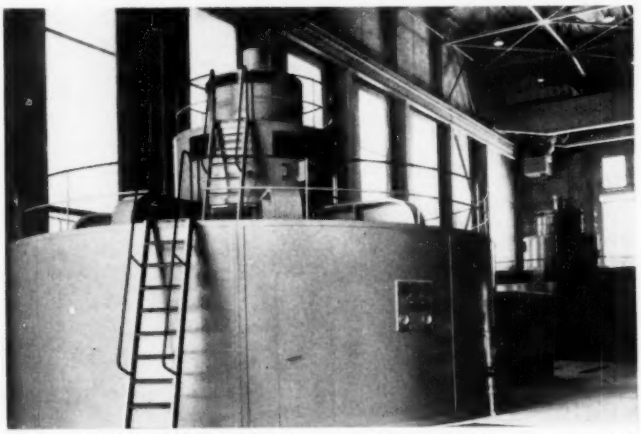
Switchyard. Highway passes between powerhouse building and mountain side at about generator floor level. With the river on one side of building, the highway on the other, and the railroad niched into the slopes 130 ft above, no space was left for the 220-kv switchyard except in the air above the highway.

A concrete deck, supported by beams and columns, 70x148 ft, spanning the highway with a vertical clearance of 21 ft, became the switchyard. The deck accommodates three 230-kv oil circuit breakers, air switches, disconnects and 220-kv bus for switching two 230-kv banks onto two 230-kv lines, and paralleling them. Space requirements of switchyard were fitted into an extremely compact arrangement.

Water Supply. Diversion dam, of the concrete, overflow gravity type, forms a 4700-acre-ft capacity forebay. The dam crest is 500 ft long. Height from bottom of foundation to top of gate piers is 115 ft. Floods of 130,000 cfs are possible. There being insufficient length of crest for a spillway to pass this amount of water and hold the elevation within tolerable limits, the dam was equipped with two hydraulically operated float-controlled drum gates. Each is 28x124 ft. They automatically maintain the intake elevation at desired maximum without permitting flood waters to inundate the highway or endanger railroad fills. Water level telemeters to the switchboard room in the station. Other gates in dam include one 15x22.5-ft radial-type spillway gate, three 6x7.8-ft sluice gates, two 24-in. gates for fish water release.



ROCK CREEK DAM uses two 128x24-ft drum gates, which float in the water chambers at dam crest. Gate installation was deferred until after the first high water



TWO 63,000-KVA GENERATORS produce 60-cycle ac at 13,800 volts with a shaft speed of 240 rpm. Thermostats automatically control water flow through the coolers

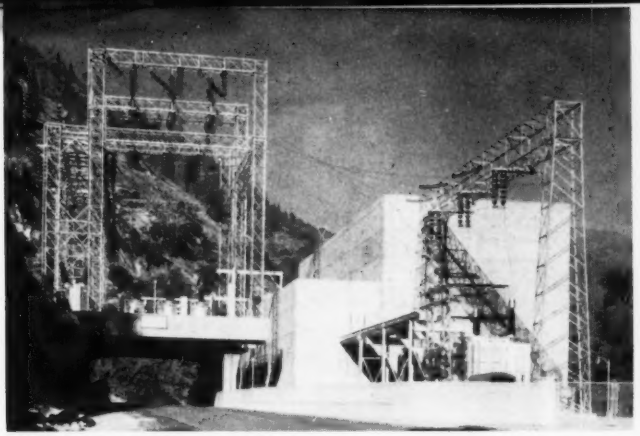
Concrete intake structure has trash racks, electrically operated rakes, 17.5x22-ft electrically operated wheel gate. Storage batteries at dam supply emergency power to insure uninterrupted regulation of water elevation.

The 34,100-ft-long pressure tunnel consists of 25-ft unlined and 21-ft-8-in. lined horseshoe sections for entire length, except an 18-ft-6-in. dia steel-lined section, 300 ft long, at lower end. A differential surge chamber, averaging 50 ft in dia by 136 ft high with 12-ft dia by 160-ft riser entirely within the mountain, connects near the lower end of the main tunnel. A tunnel, 700 ft long, 9 ft wide, 11 ft high, is driven into the upper portion of the surge chamber for construction. This tunnel now serves three purposes: (1) an access (2) air vent (3) storage gallery.

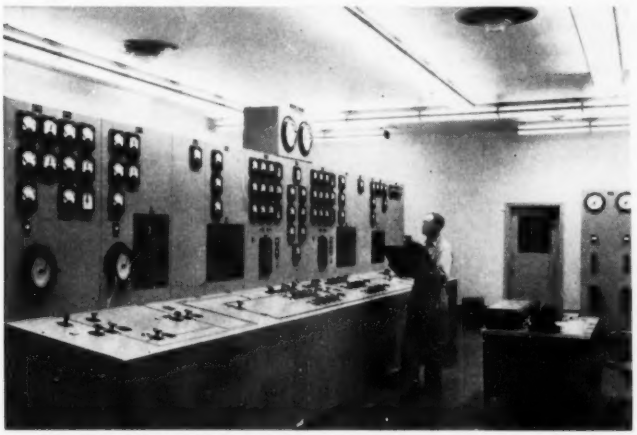
The differential surge chamber permits taking on entire plant load from hydraulically static conditions or rejecting entire tunnel flow of 3000 cfs in three minutes.

Penstocks. Two welded, steel penstocks, averaging 930 ft long, taper from 12-ft dia to 10.5-ft and connect to the tunnel through two 156-in. dia hydraulically operated butterfly valves. Above the distributor and at lower end of tunnel is a rock trap fitted with a 42-in. hydraulically operated butterfly valve for sluicing.

Penstocks run above ground about 325 ft at upper portion. Because of the railroad and highway a tunnel had to be built for lower part of penstocks. This tunnel inside the timber supports was 13.5 ft high, 28.5 ft wide, about 500 ft long. After the penstocks were



SWITCHYARD ON DECK over highway proved to be only practical way of finding enough horizontal area for this equipment without encroaching into river flow area



SWITCHBOARD AND CONTROL ROOM dimensions were affected by limited land area available for entire station—result is relatively long, narrow equipment layout

laid in place, the tunnel was filled with concrete completely encasing penstocks.

Lower end of penstocks connects to two turbine shutoff butterfly valves, 117 in. dia, hydraulically operated. Pressure water from the penstocks controls the valves with emergency operation by domestic-water pressure. However, the penstock butterfly valves and the sluice valve, mentioned before, run by oil pressure stored in a pneumatic accumulator tank. The penstock valves trip closed automatically from the differential pressure between pitot tubes corresponding to a penstock water velocity 12% in excess of the maximum normal operation requires.

Main Units. The two hydraulic governors are oil-pressure cabinet type, entirely independent of each other. Each has an individual oil-pressure accumulator tank and two oil pumps, one electrically driven, the other (auxiliary) water-motor driven, cutting in automatically on reduced oil pressure. Oil-pressure tank has both oil-pressure and oil-level failure protection. A motor-driven air compressor mounted within the actuator supplies pressurized air automatically. Two 49-in.-dia pressure regulators work jointly with the two governors. These balanced-pressure-type regulators connect directly to governor system through the turbine-gate-operating mechanism and need energy from this system to assist opening stroke.

The two vertical francis turbines are rated 73,500 hp at 481-ft effective head, 240 rpm. Static head is 535 ft. Water-conduit design based on 3000-cfs flow had been estimated to give 54-ft head loss. Changes in tunnel characteristics due to a larger percentage of lined section caused reduction in head loss to 38 ft. Actual net effective head under full static conditions and 3000-cfs flow equals 497 ft. Allowances must be made for such contingencies in planning hydroelectric station electrical output.

In a new plant turbines usually are found to have an excess capacity. The art of turbine design has not progressed to the degree of refinement where the designer can predict exact output under given conditions. He over-designs 5% or more to be sure to meet output guarantee. On the other hand, the generator builder can design much more closely.

If the turbine actually has 5-10% excess capacity from design allowances and improved head conditions, and if generator rating exactly equals the turbine rating, generator becomes the bottleneck and earnings on the entire project are limited accordingly. If the investment runs about $250-$300 per hp and the generator and transformer items combined amount to only 6 or 7% of the total, good engineering dictates that a little extra capacity be included in these two items to avoid just such a contingency. Management is never disappointed if estimated earnings are exceeded.

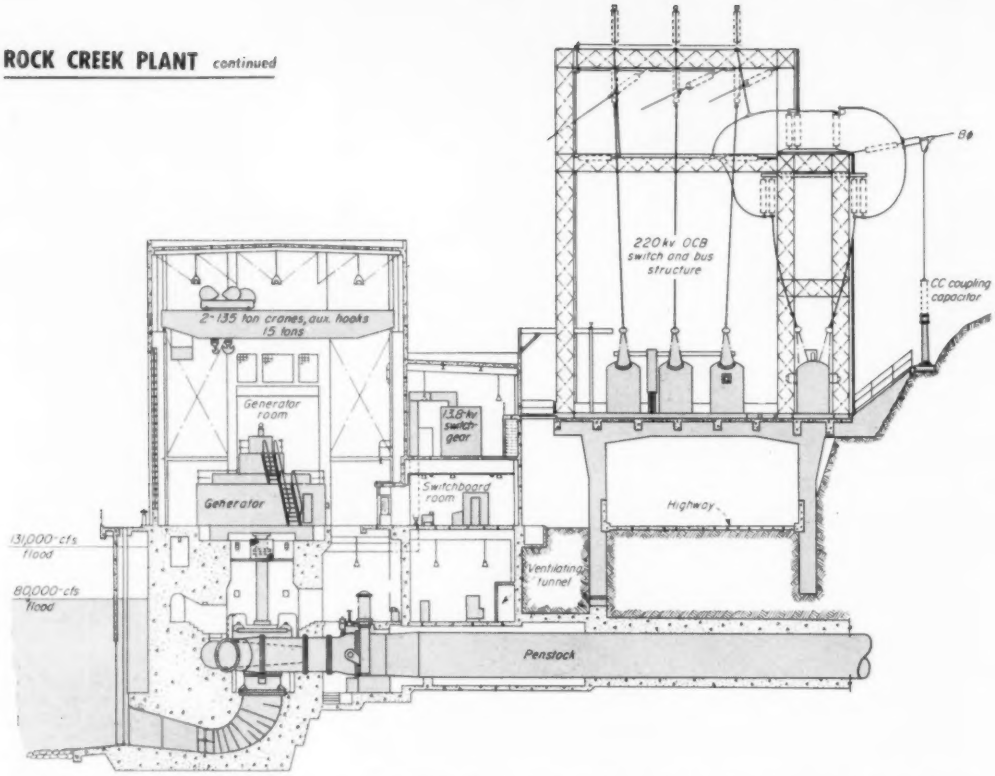
Generators, rated at 63,000 kva, 0.9 pf, 13,800 v, 60 cycles, each turn at 240 rpm. Each unit has a direct-connected exciter and surface coolers. Additional capacity was specified for the generators not only by a liberal kva rating, but also by requiring temperature guarantee be met not only at rated voltage, but also at 5% above or below rated. Liberally designed surface coolers were also specified. Thermostatic control of inlet water to the surface coolers avoids extreme temperature fluctuations and moisture condensation. Insulation is class B throughout. The short-circuit ratio equals 1.4. The generator rotor has noncontinuous amortisseur windings. The combined Kingsbury thrust and guide bearings are above the rotor.

Excitation. The direct-connected exciter is rated 20% above that needed for generator excitation under all conditions. Though the exciter armature runs at 250-v dc, the exciter field at 125-v dc is separately excited from the station control battery and diverter-pole charging set combination. This source of excitation voltage is the most stable of any in a hydro plant. One motor-driven spare exciter serves the two units. Rheostatic voltage regulators give complete control of generator voltage without a generator field rheostat.

Main shaft is hollow-bored throughout its length. A cable from the crane can be passed down through the shaft to lift and lower turbine runner during replacement and repairs.

The 13,800-v bus from the generator terminals to the transformer is metal enclosed, porcelain insulated. Generator compressed air-type circuit break-

ROCK CREEK PLANT *continued*



TWO TURBINE SHUTOFF BUTTERFLY valves are operated by pressure water from the penstock with emergency operation effected by domestic-water pressure. Penstock water velocity 12% above normal maximum automatically trips valves closed

PRINCIPAL POWER-PLANT EQUIPMENT

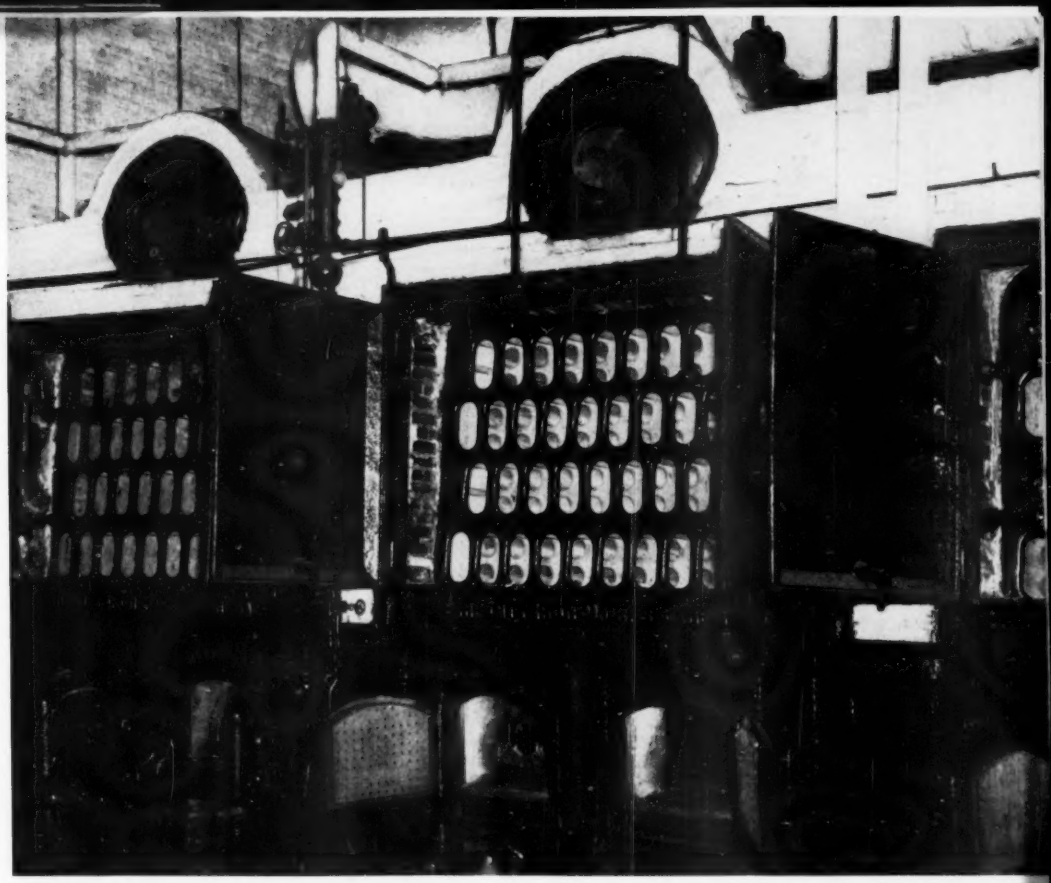
Rock Creek Power House, Pacific Gas & Electric Co.

Generators, 2 ..... Westinghouse Electric Corp
63,000 kva, 0.9 pf, 60 cycle, 13,800 v, 240 rpm
Turbines, 2 ..... Newport News Shipbuilding & Dry Dock Co
73,500 hp, 481-ft effective head, 240 rpm
Governors, 2 ..... Woodward Governor Co
Oil-pressure, cabinet type
Turbine butterfly valves, 2, 117 in., hydraulically operated ..... Newport News Shipbuilding & Dry Dock Co
Pressure regulators, 2 ..... Newport News Shipbuilding & Dry Dock Co
49 in., balanced pressure
Penstock butterfly valves, 2 ..... Westinghouse Electric Corp
156 in., hydraulically operated
Transformers, 7 ..... General Electric Co
21,000 kva, single phase, 13.8/240 kv-Y,
Low-voltage switchgear ..... Westinghouse Electric Corp
15-kv metal-enclosed cubicles, four 1000-mva air breakers
High-voltage switchgear, 3 ..... Pacific Electric Mfg Corp
230-kv, 800 amp, 2500-mva oil circuit breakers
Cranes, 2 ..... Judson-Pacific Co
135-ton with 115-ton auxiliary

ers being completely oil-free present a minimum fire hazard. Each generator to transformer bus feeds a station service transformer bank through a similar compressed-air-type breaker. This gives duplicate station power banks and each bank has either the generator or line as potential source of station power, making four sources altogether. Generator buses are not paralleled, they are tied together at 220 kv.

Main transformers are in two banks, each consisting of 3 single-phase units. One additional single-phase transformer serves as a spare for both banks. Each transformer is rated 21,000 kva, 13.8 kv/138.6 kv (240-kv wye) with four 2.5% full-capacity lowering taps from the high-voltage windings. They are 100% self-cooled without blowers. Future addition of blowers can increase capacity as needed. Tanks are positive pressure, nitrogen sealed.

High-voltage oil circuit breakers are rated 230 kv, 800 amp, 2500 mva, 5-cycle tripping—20-cycle closing. Carrier current relay protection is used.



WATERTUBE BOILER properly prepared for internal inspection. Boiler has been cooled, all covers over openings removed, and water and fire surfaces thoroughly cleaned. With right inspection, danger spots are remedied before failure occurs

Can you pay for an accident? Or would you rather prevent it by periodic inspection—be covered should one happen anyway? For units to insure, types of policies, likely amount of loss, you should know more about your plant's safety valve . . .

By **GEORGE H MENEFEE**
Baton Rouge Ins Agency, Inc

. . . Boiler and Machinery Insurance

► JUST AFTER THE CIVIL WAR, a group of New England engineers got interested in a rash of boiler explosions. Investigation showed periodic inspection could have prevented most of them. The engineers decided to offer just such an inspection service. They asked a small fee and, to make the offer more attractive, agreed to pay damages if an explosion occurred despite the inspections. From these humble beginnings came today's wide range of insurance protection for pressure vessels and machines.

Protection of lives and equipment is important, thus a knowledge of protective means is also important. This article should help you decide: (1) what units in the plant should be insured (2) type of insurance to carry on each and (3) likely amount of loss from accident to any unit. It should also make you more familiar with the services insurance companies offer.

Boiler and machinery insurance reimburses the owner for loss resulting from accident to any object insured. These losses may be: (1) damage to object itself (2) damage to other objects policyholder owns (3) damage to property of

INSURANCE ENGINEER'S equipment needed for thorough inspection of insured units includes: vibrometer, test lamps, megger, ammeter, micrometers, tachometer, revolution counter, thermometers and also gages for air gap, depth and pressure

others (4) injury to people the owner does not employ (employes are covered by Workmen's Compensation) (5) loss of valuable contents of object, such as ammonia in a refrigerating system (6) loss of the object's use, and (7) spoilage of material in process or storage.

The last item may be a direct or indirect loss as the result of an accident. If it is indirect, it is covered only by a special clause in the policy. This, however, will be explained later in the article. Let's look now for a minute at the setup of the policy itself.

The boiler and machinery policy has three parts: (1) insuring agreement (2) schedules and (3) endorsements, as follows:

Insuring Agreement. This contains amount of premium charged, dates the policy will be in effect (usually three years), and name of person or company insured. Other data include the number of endorsements and schedules attached to the policy, and the largest sum the insuring company will pay for any single accident.

Inside the insuring agreement is information on property valuation, insurance suspension by company representatives, insurance cancellation by either party, notice necessary in case of accident, inspections policyholder must permit, etc.

Schedules. These insure different groups of equipment of the same type, such as boilers, pressure vessels, steam and water turbines, electrical machines (generators and motors), miscellaneous electrical equipment (switchboards).

All schedules in the boiler and machinery policy are similar, so a description of the **boiler** schedule, the one most frequently used, will serve as illustration. Front face of the schedule is used to identify the exact object covered and type of insurance afforded. Space is provided for serial number of owner or manufacturer and a brief description of the object. For a boiler, this includes type, diameter of shell or heating surface, whether unit is high- or low-pressure type (below 15 psi is low pressure). Space is also provided to state whether boiler is insured for limited or broad coverage, whether boiler piping is insured, what type fuel is used, and whether furnace-explosion insurance is included. Just a word or two on these various coverages just mentioned.

Limited coverage provides only for explosion of the object, while broad coverage provides also for damage from overheating the boiler due to low water. Boiler-piping coverage extends the insurance to cover piping attached to the boiler, such as steam, blowdown and feed piping. Furnace-explosion insurance covers the hazard of gas explosion within the normal gas passages between the firebox and top of stack. This is often provided, however, by extended coverage on standard fire-insurance policies, and duplication is unnecessary.

The back of the boiler schedule is used to define a boiler, and to define an accident under a policy including broad or limited coverage, and furnace-explosion or boiler-piping insurance.

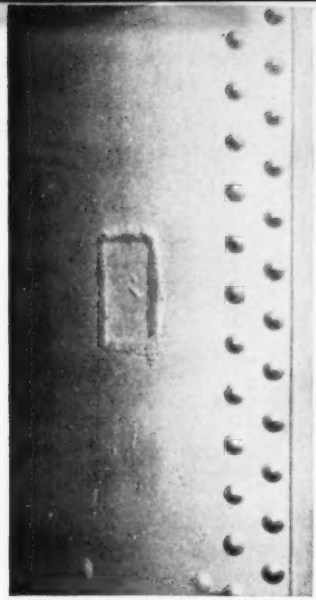
Endorsements. These expand or limit the coverage provided under the standard insurance policy. They may insure the owner for (1) loss of use of the unit (2) spoilage of material in process or storage (3) certain other possible listed losses.

Let's look at some of the more important endorsements in the boiler and machinery policy.

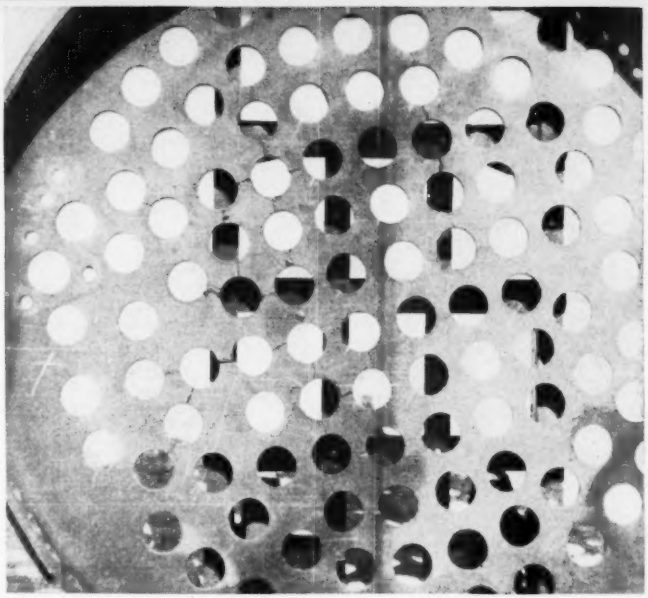
Use and Occupancy. This provides payment for loss of profit or other hardship arising out of loss of the insured object. It is written effective at the time of an accident or several days after. The time selected usually depends on how soon production will be affected after the accident happens. Charge for this insurance depends on how soon after the accident the insurance takes effect—the sooner, the more costly. Charge is also based on daily amount of money the insurance company must pay.

Consequential Damage. This is designed to insure against spoilage of material resulting from an accident to a piece of equipment listed in the schedules. Loss must be due to spoilage caused by lack of heat, light, power, steam or refrigeration.

For example, if the ammonia receiver in a refrigerating



FLUSH PATCH in unstayed part of boiler shell cuts strength, wouldn't be OK'd



CRACKED LIGAMENTS in tube sheet of this vertical tubular boiler might well have resulted in an explosion. The potential disaster was found by a boiler inspector

system blows up and the fumes damage foodstuffs in cold storage, direct-damage insurance will cover the foodstuff damage. If, however, the crankshaft on the refrigeration compressor breaks and the foodstuffs in storage spoil from lack of refrigeration, damage to the compressor is insured under the schedule where it is listed. But the spoilage is not a loss under the policy unless the consequential damage endorsement is included in the policy. First loss to the foodstuffs is direct; the second is indirect.

Reserve or Seasonal Object. This form credits the policy holder for non-use of objects normally held in reserve, or used only seasonally. Credit is given on the insurance premium charged. This form does not apply to low-pressure heating equipment.

Inspection Service. One of the most important services insurance companies render is inspection. Qualified engineers are employed and trained in accident-prevention work. They are then sent into the field to make routine tests and inspections of all insured boiler and machinery objects. Their primary work is to spot accident-producing conditions and make corrective recommendations to the policyholder.

Note here that the insurance policy states the right of the insurance company to make periodic inspections of insured equipment, but regulation forbids promising inspection at any stated time or with any stated frequency. Insurance companies usually try, however, to inspect boilers twice a year and machinery objects three times a year.

Because of the value of this service, boiler and machinery insurance is bought as frequently for the inspections as for the damage payment in case of an accident.

Opinions of inspecting insurance engineers are based on such factors as: (1) design and use of equipment for service intended (2) satisfactory design, (3) ability of operating personnel to perform assigned jobs (4) past accident history of the insured unit (5) interest in and response to suggestions and recommendations (6) general conditions of plant and (7) existence of regular maintenance schedule.

After an inspection, the engineer makes corrective recommendations he feels warrant the attention of the plant management. These generally fall into three groups:

Urgent recommendations on serious conditions: Failure to comply may result in insurance suspension on defective unit until it is repaired.

General recommendations to correct conditions that may cause an accident, but not in the near future. They are also made to correct conditions that would improve operation or increase production.

Special recommendations to correct violations of state or municipal laws: In states or towns having laws governing operation and repair of boilers, insurance engineers are usually deputy state inspectors and are required to submit reports on their inspections. If law violations are found, a report is forwarded to the policyholder. In this case failure to comply often results in a fine.

Choice of an insurance company should be based on three fundamental considerations: (1) Financial status of the company—its ability to pay losses that may occur. (2) Ability of the underwriters to design an insurance program to fit the particular plant. Thought must be given to the amount of damage that an accident might cause, how the various pieces of equipment fit into the production scheme of the plant, and how much effect an accident to a piece of equipment will have on production. (3) Quality of the inspection service. Part of the insurance premium on each unit is set aside for this service, sometimes as much as 40%.

Since the benefit from prevention is far greater than from payment for accidents, thoroughness of inspection is highly important. The insurance engineer should be provided with equipment to permit checking thoroughly the condition of the insured units. Inspection reports to the policyholder should detail the condition of the inspected equipment.

We hope this closeup of an important type of insurance will help you advise your management on a sound insurance program. Any good company will give individual attention to your problems. But before going into special cases, arm yourself with the pertinent points in this article.

INSPECTOR looks over calcium silicate insulation on large steam drum. Structural strength of this insulation permits moderate loads without crumbling. The workmen and inspectors walk on covered parts, don't worry about damaging them

Insulation Roundup: A Quick Look Into the Future

The first eight parts of this handbook covered many insulations used today. Now we wind up with condensed facts that predict future trends

By **PHIL SWAIN**, *Editor*

► TODAY YOU NO LONGER ASK yourself, Is there an insulation for my job? Instead, the question is, What's the best insulation for it? That's because there are modern insulations for every temperature range in power and industrial work.

Insulation Choice. Let's say you have a 500-F pipe to insulate. Job specs permit you to use 85% magnesia, amosite asbestos, cellular glass, calcium silicate, or an equal. Since prices and efficiencies don't differ widely for materials usable at this temperature, other factors will influence your choice.

Installation cost, maintenance, dimensional stability, strength and weight are a few you must consider. So you'll find, for an industrial plant where dust is a nuisance in production areas, an insulation that doesn't flake or disintegrate is best. To get this property it may be worthwhile to sacrifice a few points in efficiency or pay a slightly higher price.

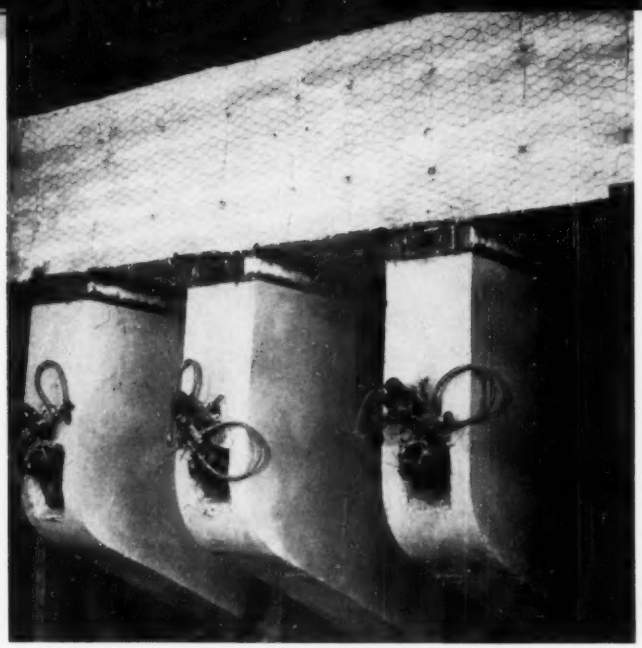
In other words, don't buy insulation on the basis of one property. Consider all properties in terms of your job.

Higher Temperatures. Steam- and industrial-plant temperatures have been on the rise for years. We expect this trend to continue, with the rise in industrial power and process units accounting for much high-temperature piping.

You'll see more high-temperature insulation in industrial plants. It may be calcium silicate, diatomaceous silica, cellular glass or dual layers of other insulation with an inner high-temperature layer and an outer low-temperature layer. Then, thick mineral-wool blankets or other insulation may be used. Up to 700 F, asbestos-sponge-felt insulations will get greater play.

With higher process temperatures you'll need more small-tubing insulation. Tapes and seamless felted and braided insulations protect operators from burns, save heat.

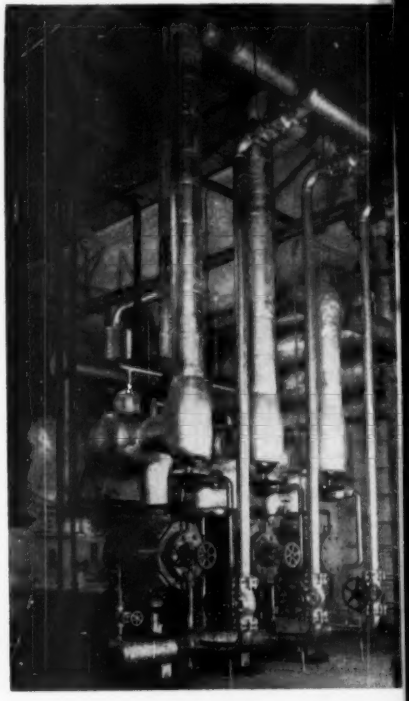
Castables. For boiler and industrial furnaces more castable and plastic insulations will be applied in the field.



HOT-AIR DROPS to boiler low-load burner boxes are insulated with 1 in. high-temp and 2½ in. regular 85% magnesia finished with asbestos cement. Mesh on duct

CELLULAR-GLASS duct insulation, vapor-seal type, stops sweating of cool ducts

CORK for refrigeration pipes does fine job, makes a neat-looking installation



These, we believe, will gradually supplant preformed and prefabricated insulations on certain jobs.

Talking about castables, here's a kink that isn't new in oil refineries but some power engineers seem to have overlooked it. It is use of castable insulations in large-diameter pipes and vessels. Castable is applied in interior where it does a good job of protecting metal against high temperature and cutting heat loss. Castable insulations are also good for ducts carrying heated air or gas.

Simplified Dimensions. As material and labor costs rise, insulation manufacturers do their best to hold prices down. One way of keeping over-all cost down is to simplify installation so job is easier and fewer men can do it. Simplified dimensions are one answer.

Precision-made, nested insulation fits standard pipe sizes snugly, permits adding more layers at lower cost. Original layer isn't removed to install the second. This idea is bound to catch on with more manufacturers. Some day soon you'll find you're stocking fewer sizes of your favorite insulation because you don't need as many to do the same job when material can be nested.

Old Reliables. What about these? Are 85% magnesia, mineral wool, and other well-known insulations doomed, bound to die a quick death in a high-temperature industrial world? Answer is an emphatic no.

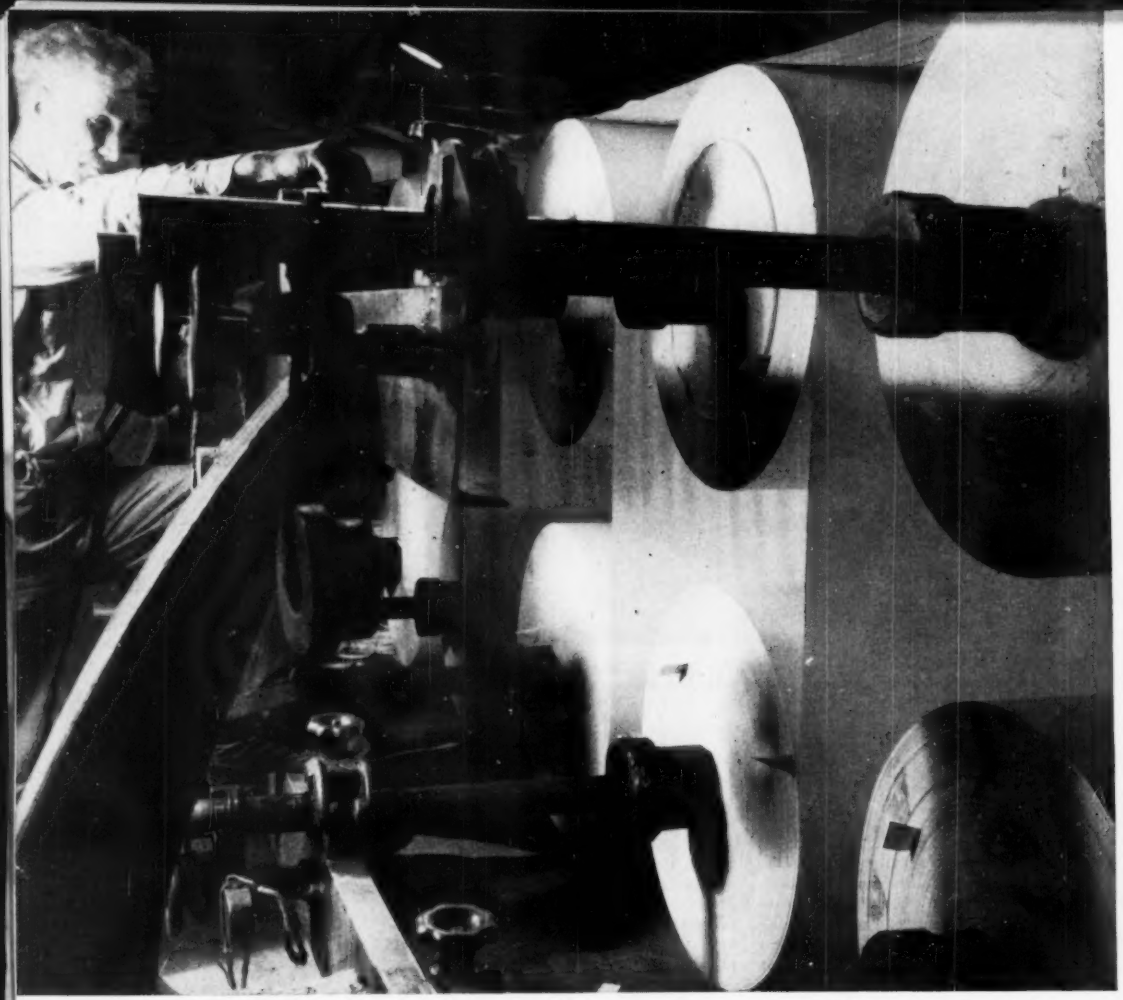
The better-known insulations have proven their worth over the years. In suitable temperature ranges they will continue to save heat. This means fewer of your operating dollars will be used for worthless heating of atmospheric air.

And the old reliables will improve. If not in efficiency, then in application and finishing methods. The heat-insulation field has never been static; research and testing labs are more active today than ever.

Reflective Insulations. Educational program for introduction of this type is about at an end. As recognition of this insulation grows it will find wider use. Research is now under way on multiple-layer aluminum foil for temperatures down to –70 F. If you're a refrigerating engineer, keep an eye on this material; it may save dollars for you in new and old plants.

Cold Jobs. Cork, mineral wool, cellular glass, hair felt and others are a few of the insulations that will continue strong for low-temperature work. Keep up with developments in application; that's where you'll be able to save most.

Lastly, keep up your study of all insulations. POWER will publish all the latest data; read them and you'll learn best ways to keep heat in its place.



PULP AND PAPER INDUSTRY has been expanding since World War II, ranked second of twenty major industries in steam generating equipment purchases by 1946, with more planned. New plants employ the best equipment, instrumentation, controls

Steam Making in Paper Mills Sets New Levels

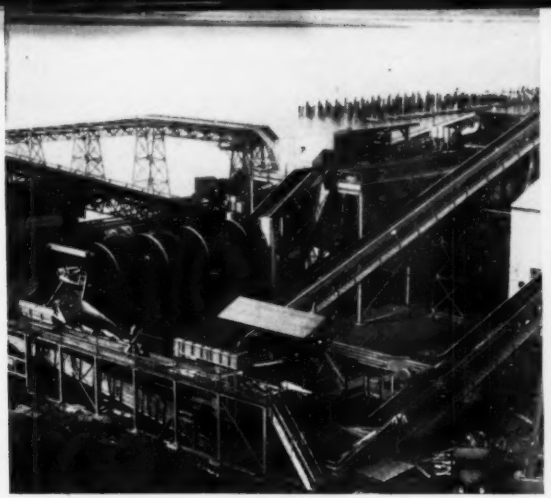
By J E TOBEY, C F HARDY, A L JORDAN *Appalachian Coals, Inc.*[1]

- **Bark burning and black liquor together furnish nearly 50% of steam requirements in mills using them**
- **More multiple fuel-burning equipment is going in**
- **Pressures and temperatures move steadily up**

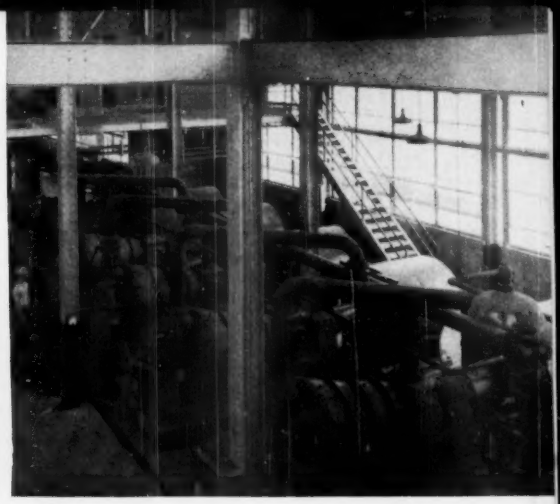
► THE PULP AND PAPER industry stands out as one of the leaders in the phenomenal industrial expansion of the South. This industry alone plans to spend over $100 million in the next few years, and 80% of it is estimated as scheduled for the South. What effect will this expansion have on the pulp and paper mills' power plants?

To get the answers, we surveyed personally or through questionnaires 37 plants in 11 states in the South covering 273 boilers on the line and 10 in the design or construction stage. General condition of the 23 plants we contacted personally ranked high above the av-

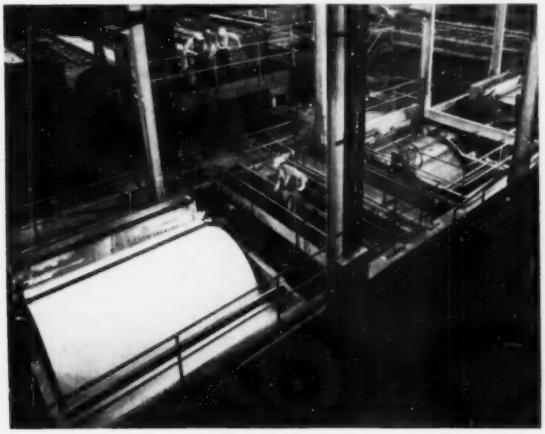
[1]Based on a paper "Design Trends in Boiler Installations in the Pulp and Paper Industry of the South," by Tobey, Hardy and Jordan. Presented before the Technical Association of Pulp and Paper Industry, Savannah, Georgia, on October 15-18, 1951.



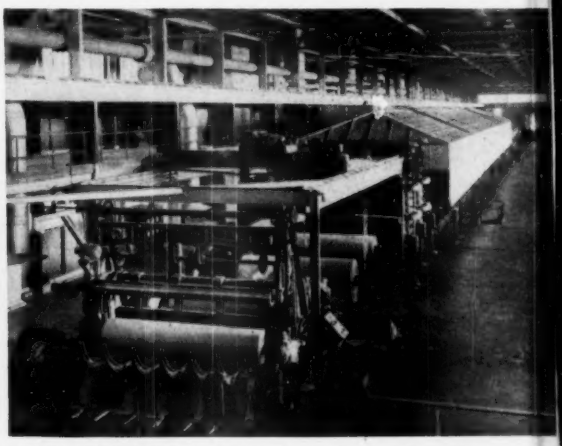
REMOVING BARK prepares wood for processing and supplies a highly valuable fuel that carries about 20% of steam demand



TODAY'S pulp and paper mills make heavy demands for electric power as well as steam. Jordans, shown above, are typical user



MANY MILL PRODUCTION processes require close electrical controls, adequate pumped supplies of water for precision work



HEAVY STEAM USERS in kraft mills are dryer machines like this 2200-fpm unit feeding battery of Pusey & Jones winders

erage of all plants we've surveyed over a period of years. Their boiler-room equipment was in good repair, well operated.

Only 59 of the 283 boilers making up this survey were put in before 1936; 109 have been installed since 1945. This last group we designated as *postwar* and those before as *prior 1945*.

Pressure Levels. In general, boilers going into the pulp and paper industry[1] reflect the latest design at the time of installation and show progressively higher pressures and temperatures, table on p 91, Fig. 1 on p 90. By careful planning these new, higher-pressure units going into existing plants are fitted in so their output is coordinated with older, low-pressure systems. One plant we surveyed has three such operating levels—160 psig, sat; 400 psig, 590 F; 600 psig, 720 F—and we know that many others have similar conditions. Several mills fit in combination topping and bleeder turbines between new and old levels.

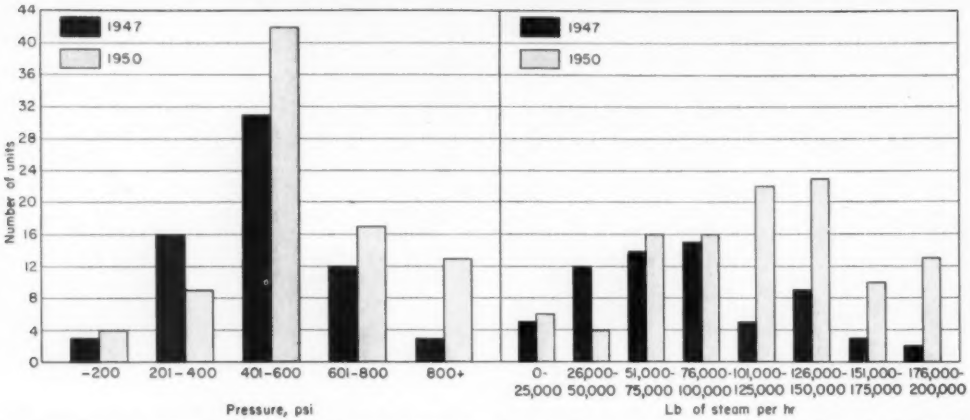
There's good reasoning behind such a decision. One mill put in a 1250-psig 950-F topping unit that has afforded even greater economies than original studies indicated. We feel, and other engineers share our feeling, that closer studies will reveal the topping unit's fuel-economy advantages can be put to still wider application in the pulp and paper industry.

In addition to the table, Fig. 1 shows how fast this trend to higher pressures and temperatures is being felt. The solid black bars in the pressure and capacity illustrations are from a 1947 survey of the pulp and paper plants in the Northeastern states[2] and the other bars are the postwar figures from our current Southern states' study. We place them side by side to picture all changes graphically.

The paper mill industry traditionally tends to divide up its boiler load among several smaller boiler units rather than go to fewer large steam generators. A million-lb boiler would be extremely unwieldy in practically any pulp and paper mill. Yet sometimes there is a

[2] "A Fuel Engineering Study of Some Recent Boiler Installations in the Pulp and Paper Industry," J E Tobey, *Paper Trade Journal*, December 18, 1947.

PRESSURE LEVELS AND STEAMING CAPACITY KEEP CLIMBING TO MEET PROCESS, POWER NEEDS



1 Definite move toward higher-pressure boilers reflects a trend to greater economy in steam and to topping turbines

2 Selection of capacity units shows industry's traditional tendency to split up the steam load among smaller boilers

tendency to select unduly small-capacity units in view of the total plant steam load.

The tremendous strides of recent years, increasing dependability and availability of boiler equipment so it is now better than 90%, indicate longer on-line operations possible for the average industrial plant between scheduled outages. Further, the utility industry has pointed the way to achieving these longer operating periods.

As an example, the pressurized furnace represents a definite advance in boiler design with its promise of (1) higher efficiencies through lower excess air resulting from no infiltration (2) lower maintenance (3) less auxiliary power by eliminating the induced-draft fan. Five of these units are now on order for the pulp and paper industry.

The bar chart showing the capacity preferences, Fig. 2, is again a side-by-side presentation of the 1947[1] survey and this current one.

Fuel Choice. The special grouping of Fig. 4 pictures a trend toward equipping boilers to fire more than one fuel. Black-liquor boilers were not included in this presentation because their prime purpose is recovery. Purchased fuel serves as a supplementary fuel only. This same reasoning holds only partially for bark-burning boilers because bark frequently serves as an alternate or secondary fuel with power boilers.

Of the 176 boilers making up Fig. 4, most, 110, went in before 1945 and 66 after. Of the older boilers, 58% could handle only one fuel. This situation is almost reversed among postwar units, with 54.5% capable of handling two or more fuels. Those units, capable of firing oil and natural gas only, crop up principally in Louisiana, Mississippi, Texas—the Gulf Coast as you might expect. Oil and coal share most of the business along the Atlantic Coast. And in the interior, away from water-borne oil or natural-gas pipelines, coal holds sway.

What about the plants with black-liquor recovery units? What fuels do they select and what percentage of the steam load do they carry? Fig. 3 breaks this down. We recognize that the percentage of recovery varies from plant to plant, and the percentages pictured here hold only for the kraft mills covered in this survey. It is interesting to note, though, that nearly 50% of the steam requirement for these kraft mills can be met by two byproduct fuels—bark and black liquor. Chances are bark carries a higher percentage of the total load than Fig. 3 shows because some boilers list it as a secondary or alternate fuel.

The table summarizes the number of units for each fuel and firing method, average size, pressure, temperature for *prior 1945*, *postwar*, and for the entire period: Totals show for each fuel and firing method.

Pulverized Fuel. By studying all boilers in the 37 plants we found 28 pulverized coal-fired units put in between 1926 and 1945, 11 between 1945 and 1949, and three on the drawing boards. They illustrate a definite downward trend in furnace heat release from 28,000 Btu per cu ft *prior 1945* to 23,330 *postwar*. Efficiency jumped from 82.7 to 84% postwar. Design heating value of coal dropped from 13,500 Btu per lb to 13,020 although in each group we found boilers designed for as low as 12,000 Btu coal.

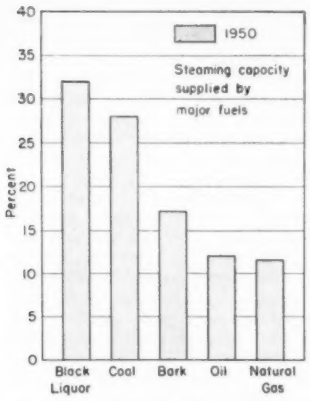
The last boiler equipped with pulverizers built for a coal of 90 grindability (Hardgrove) went in in 1938, and the over-all average for the *prior 1945* was 67 against a *postwar* figure of 55. In view of the range of high-grade coals available to the Southern market minimum grindability should be 45, as it was in one case, and never as high as 67.

Spreader stokers first entered the power boiler field of the surveyed Southern pulp and paper mills in 1946. Today, among these same plants, there are 12 pneumatic feed designs and 4 mechanical. Of recent years, more interest in spreader stokers has developed, especially where bark will be fired in the same furnace. Two 275,000-lb-per-hr units reported they can burn bark in combination with coal by blowing it in with air at 15 ft above the grates.

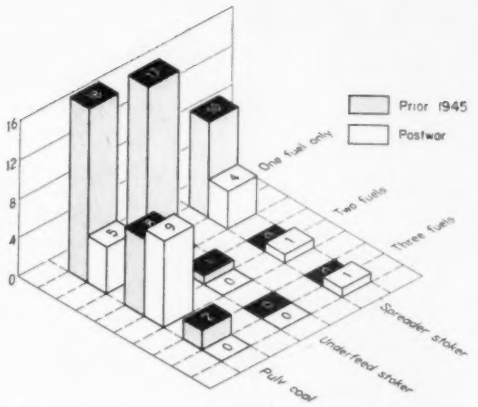
Multiple-retort stokers totaled 18—all put in before 1943. Largest is on a 75,000-lb-per-hr boiler, and the average supplies a 38,000-lb-per-hr load.

Fuel Oil. There were 12 plants reporting a total of 28 boilers whose primary fuel was oil. They represented 11.99%

WIDER FUEL CHOICE COMMON



3 Range of primary fuels in use shows industry's awareness of waste fuels



4 Survey pictures a swing toward fuel flexibility with over one-half of the units going in set for more than one fuel

AVERAGE SIZE, PRESSURE, TEMPERATURE OF BOILERS INSTALLED AND TOTAL OF ALL UNITS FOR EACH FUEL

	Prior to 1945				Postwar				All units						
Primary fuel	*Units*	*Size M lb*	*Press.*	*Temp*	*Units*	*Size M lb*	*Press.*	*Temp*	*Units*	*Size M lb*	*Press.*	*Temp*	*Total capacity*	*% total capacity*	*% fuel purchased*
Pulverized coal	28	135	433	641	14	177	553	723	42	149	473	668	6,267,000	24.67	
Underfeed stoker	18	38	253	535	—	—	—	—	18	38	253	535	683,000	2.71	
Spreader stoker	10	11	140	361	6	117	334	565	16	51	205	429	807,400	3.20	
Total or av	56	82	322	557	20	145	487	676	76	61	364	586	7,757,400	30.58	56.25
Black liquor	66	45	373	579	41	109	547	709	107	69	429	616	7,386,200	29.13	
Bark	23	75	467	671	23	107	494	691	46	91	479	680	4,185,700	16.51	
Oil	17	77	466	680	11	157	611	749	28	109	523	707	3,039,750	11.99	22.06
Natural gas	12	77	387	588	14	147	556	685	26	115	478	640	2,990,000	11.79	21.69
Total or av	174	70	379	595	109	127	532	700	283	93	433	630	25,359,050	100.00	100.00

of the total capacity with the individual averaging 77,000 lb per hr at 456 psi, 680 F. The 11 that came on the lines postwar averaged 157,000 lb per hr at 611 psi and 749 F.

In the area where natural gas is available at low cost it serves as a primary fuel and also as (1) supplementary fuel in bark-burning boilers (2) ignition in black-liquor boilers. Twelve are *prior 1945*, averaging 77,000 lb per hr at 387 psi and 588 F. Fourteen postwar units supply an average of 147,000 lb per hr at 556 psi and 685 F. Overall, this fuel handles 11.57% of the total surveyed capacity.

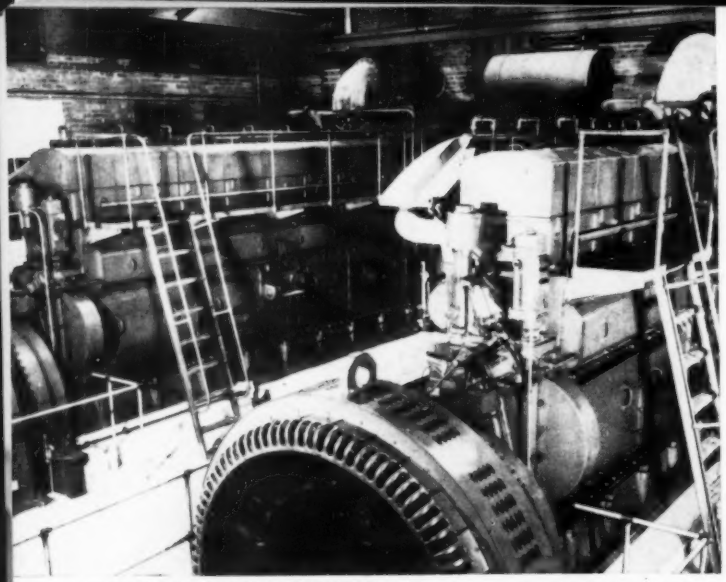
Since 1948, bark burning has been swinging over to spreader stokers as the preferred firing method with a survey score of six to two against the cell method. From 1945 to 1948 the business was split 4-4 for spreaders and cell units. But going back before 1945, we find no spreader representation until 1937, when the first one went in. During that period the inclined grate cell predominated with a few cone types, both with and without grates.

Surveyed installed capacity of all types employing bark as a primary fuel represents 16.6% of the total reported. Twenty-three postwar designs have an average capacity of 107,000 lb per hr each, at 494-psi pressure and 691-F temperature. Twenty-three *prior 1945* units showed a 75,000 lb per hr average at 467 psi and 671 F.

Black Liquor. While chemical recovery is the primary purpose of these units they produce 31.76% (7,386,200 lb per hr) of the total steaming capacity of all surveyed plants. Average size of 66 *prior 1945* installations was 45,000 lb per hr at 373 psig and 579 F. For the 41 postwar installations, these figures became 109,000 lb per hr average at 547 psig and 709 F.

This latest set of averages reflects the rapid strides in the use of water-cooled furnaces in recovery boilers as against the earlier day's low-pressure low-capacity refractory furnace.

Summary. In general, the pulp and paper industry has established itself as among the leaders in selecting its new steam-raising equipment, and in use of higher operating pressures. There is possibly an overstrong tendency toward the conservative in selecting more small-capacity boilers rather than fewer high-capacity units. The remarkable availability records of the central station units may change this tendency.



SUPERCHARGED DUAL-FUEL ENGINES at Central Kansas Electric Cooperative, Great Bend, Kansas—first central station to operate exclusively on units of this type

- **Supercharging and intercooling boost fuel economy, reduce investment in plant and buildings**
- **Dual-fuel engines give high efficiency on either oil or gas, permit instant fuel changeover**
- **For gas alone, new high-compression spark-ignition units yield low operating costs**
- **So don't miss these good bets when you . . .**

Select New Engines to Cut Your Power Costs

By **VOLNEY M HOLMES**, *Worthington Corp*

► SNOWBALLING POWER requirements face plant owners and operators in all parts of the country. And along with growing demand come rising costs of fuel, labor and all the other elements going into power production. So when you think about plant expansion, don't overlook the cost-cutting possibilities resulting from engineering advances in the fast-moving postwar years.

This angle demands particular attention in the internal-combustion field, because recent big strides there offer important dollar-saving opportunities. Let's review the principal forward steps and then see what they can do toward bringing power production costs down to rock bottom.

Supercharging with exhaust-driven blowers, successfully applied to heavy-duty stationary engines before World War II, came into wide commercial use in the postwar period. In addition to cutting fuel costs some 10 to 20%, supercharging boosts engine output without increasing space requirements or cooling-system load. This yields substantial gains in plant capacity per dollar of first cost.

Intercooling. When ambient air temperature exceeds 90 F, it is customary to derate engines 2.5% for each 10-F rise or provide some means of intercooling the air between turbocharger and engine cylinders. (For each degree rise in ambient, exhaust temperature also rises about two degrees.)

Intercooling may be used to avoid derating at high ambient temperatures, or, more important, to increase engine output at normal ambients. It thus further extends the gains made possible by supercharging.

For water-to-air intercoolers of practical size, 4 to 5 gpm of 90-F water is needed for each 100 hp of full-load engine rating. Water at lower temperatures cuts these needs proportionately.

Dual-Fuel Engines. On the heels of the wide application of supercharging came the dual-fuel engine, first in naturally aspirated versions, then in supercharged form. These units burn either oil or gas (or both) at full diesel compression pressures. A small quantity of oil is injected to initiate and stabilize combustion when burning gas. Shift from one fuel to the other may be made instantaneously, under load.

Control may be arranged so half of governor travel regulates the engine on gas, the other half on oil. With this scheme, changeover is automatic if supply of either fuel fails. Worthington engineers, however, recommend using full governor travel for greater stability. If automatic changeover, which this system doesn't normally provide, is desired a newly developed control can be added.

Improvements in control of gas flow to cylinders, in pilot and main fuel injection, and in air-fuel-ratio regulation give today's dual-fuel unit better part-

load efficiency and reduced pilot-oil consumption.

Dual-fuel design permits burning gas at diesel efficiencies and, perhaps even more important, gives full fuel flexibility in areas where oil and gas are competitive or where gas supply may be interrupted.

High-Compression Gas Units. Development of suitable ignition equipment and advances in gas-combustion know-how now make it possible to operate otto cycle gas engines at higher compression pressures and hence higher efficiencies. For areas where gas is the primary fuel, these units have an edge because they require no pilot oil.

Requirements of an ignition system for high-compression engines are: (1) sufficient voltage to arc the gap—25 to 30 kv (2) magneto of suitable capacity (3) spark plugs capable of withstanding high-voltage bombardment across gaps with minimum electrode erosion (4) special heavy-duty spark coils.

Both gas and air in these spark-ignition units are under governor control. Balanced air-metering valves in intake elbows connect to governor, maintain proper air-fuel ratio at all loads.

As built by Worthington, all features of dual-fuel and spark-ignition engines are the same except for ignition and fuel-injection systems. Thus units may be adapted for any of the three modes of operation.

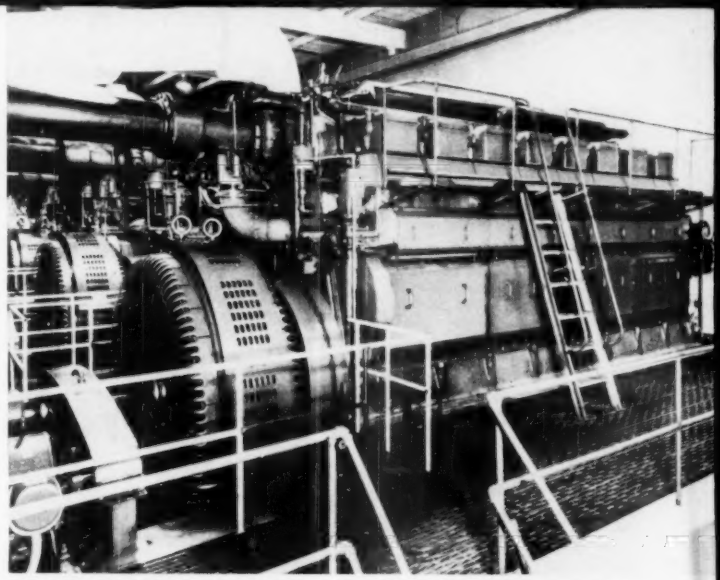
Performance. At full load, using lower heating value of fuel, thermal efficiencies compare as follows:

	Total Btu per bhphr	*Thermal efficiency*
Oil-diesel	6700	38%
Dual-fuel	6500	39%
Spark-ignition	6600	38.6%

These efficiencies indicate little choice between these engine types, other things being equal. To see the influence of other factors, let's look at an actual case.

Operating Figures. At Oskaloosa, Iowa, the Iowa Power & Light Co operates four dual-fuel engines 10 to 12 hours a day at an average of 96.2% of full load. One engine actually operated at an average of 100% load. During the past two years, these engines generated a total of 31,949,100 kwhr.

With gas at 12¢ per 1000 cu ft and pilot oil at 10.364¢ per gal, total cost of fuel the first year was 2.1 mills per kwhr. During the second year gas and oil rose to 14.966 and 10.574¢, respectively. This brought fuel cost to 2.6 mills per kwhr.



FOUR DUAL-FUEL UNITS at Iowa Power & Light Co's Oskaloosa plant averaged more than 96% of full load for ten to twelve hours per day, and hung up low fuel cost

To obtain these favorable rates, engines had to change over to 100% oil operation on short notice. Over the two years, they operated on oil 2% of the time. Now let's compare these results at Oskaloosa with those of oil-diesels and spark-ignition engines operating under the same conditions.

Fuel-Cost Comparison. For oil at 10.364¢ and gas at 12¢, the comparative costs are:

Oil-diesel	7.3 mills/kwhr
Dual-fuel	2.1
Spark-ignition	1.2

And with oil at 10.574¢ and gas at 14.966, they stack up this way:

Oil-diesel	7.4 mills/kwhr
Dual-fuel	2.6
Spark-ignition	1.6

Based on 16 million kwhr per year (approximately half actual production for the 2-yr period), what were the savings on dual fuel and what would they have been on gas alone, both compared with 100% oil? Here are the figures: Dual-fuel operation saved $83,200 the first year, and $76,800 the second, for a total of $160,000. For gas alone, savings would have been $97,600 and $92,800, a total of $190,400.

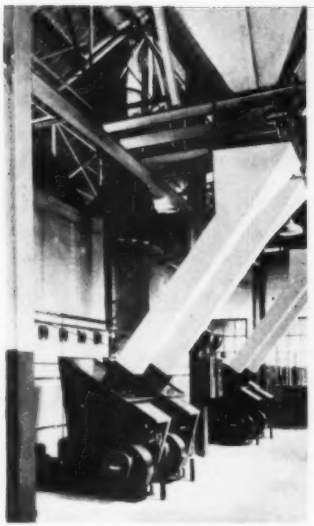
These savings emphasize the importance of selecting engines to take full advantage of fuel-cost differences and of checking the possibilities of converting existing engines to more economical operation.

Cutting Fuel Costs. Early in 1949 the city of Vermillion, S. D. studied ways of reducing power costs, decided to convert their 750-hp 327-rpm diesel to dual fuel. At the same time, they took advantage of supercharging and stepped up to the next synchronous speed, 360 rpm. Before conversion, engine had seen 12 years of constant service.

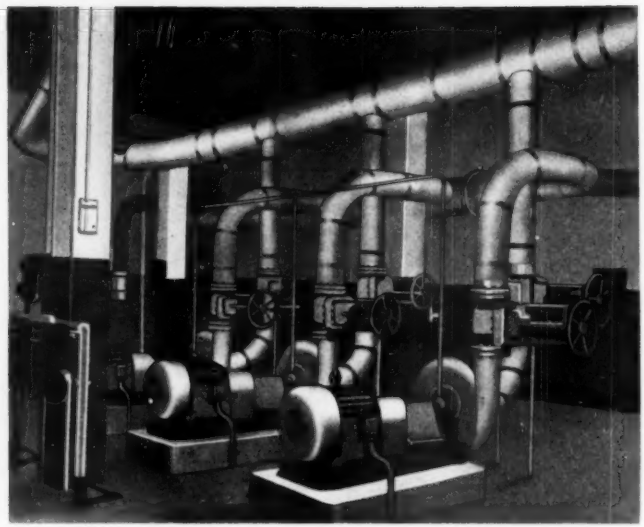
The converted engine pulled fuel costs down to 3.1 mills per kwhr on 21.2¢ gas, compared with the former 8.5 mills on 11¢ oil. In addition, the changes boosted engine capacity 60% and reduced production costs on the output of this engine 63.5%.

Another Case. Without making any building alterations, Waverly, Iowa gained 1020 kw by supercharging and "upping" the speed of three of its four units. The first year after conversion was completed saw an average of 11.1% more kwhr per gallon of fuel.

In 1949, when establishing a new power plant and adding a fifth engine to its system, Waverly provided for using natural-gas fuel not then available. The progressive superintendent of municipal utilities has just converted his fifth engine to dual fuel for burning propane. On this fuel a saving equivalent to 1.5¢ per gal of fuel oil is anticipated. With 10.25¢ oil—present delivered price—this represents an estimated fuel-cost saving of 14.5%.



1 **CONTROLLED-CIRCULATION** boilers are good hot-water heat sources



2 **CENTRIFUGAL PUMPS** of special design circulate superheated water through h-p h-t systems. Piping must be carefully sized so pumping head is not excessive

Widely used in Europe, high-pressure high-temperature hot water may be an answer to your process or industrial-heating problems. This article, first of two, tells you what h-p h-t hot water does, how to apply it in your plant

By OWEN S LIEBERG, *President, American Caliqua Co*

H-P H-T Hot Water Saves Fuel, Cuts Industrial-Heating Maintenance

► COMPONENTS of high-pressure high-temperature (h-p h-t) hot-water systems are a heat source, often a controlled-circulation boiler, Fig. 1, a circulating pump or pumps, Fig. 2, supply and return piping, Fig. 3. Heating units connect across supply and return lines, Fig. 3.

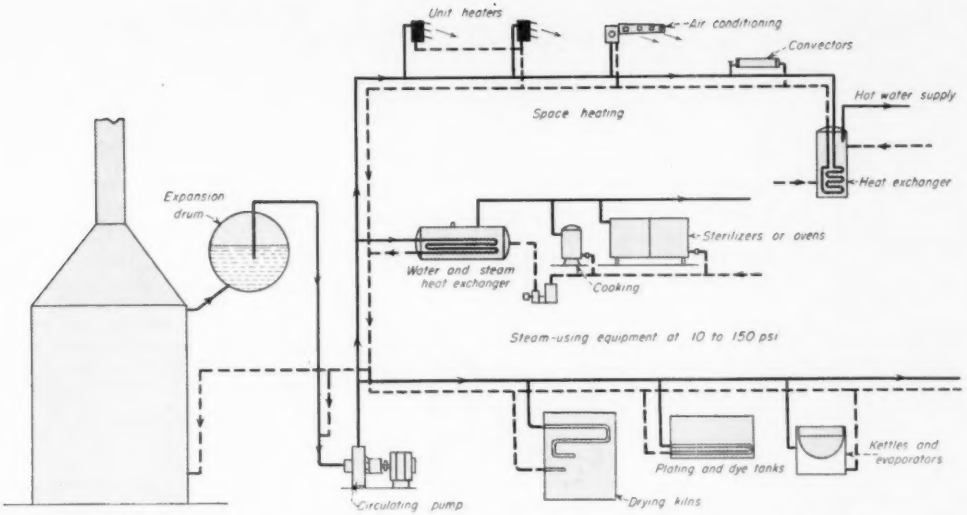
System Principles. Water for circulation through the system is heated to between 250 and 400 F. System pressure is kept higher than saturation pressure corresponding to water temperature. So the water is superheated and some engineers refer to this type as a superheated-water system.

Why superheat water for heating? Take a look at the table, p 96. Last column shows you get 52.9 times more heat from a cu ft of water at 125 psia than from a cu ft of steam at same pressure. At low pressures, difference is more pronounced—you get over 185 times more heat from water than from steam at 25 psi. Of course, these are maximum values and in actual practice heat yield may be less, but differences are still eye openers. Incidentally, if Bailey's theory, POWER, March, pp 74-78, is correct, h-p h-t hot water has a slightly greater edge than the above figures show.

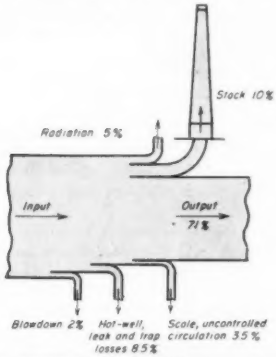
Heat Source. Water is heated by (1) either the extraction or backpressure steam in power stations (2) controlled-circulation boiler (3) heat exchanger using steam (4) or a waste-heat boiler.

With four possible ways of heating water, use of a h-p h-t system is simple in both new and existing plants. Fig. 3 shows a typical controlled-circulation boiler hookup and some process units utilizing the heated water. Fig. 6 shows a controlled-circulation boiler while Fig. 4 and 5 show the typical energy distribution in steam and h-p h-t hot-water systems. Advantage of boiler and process system with fewer losses is easily seen.

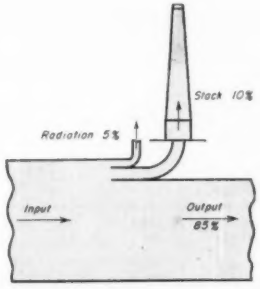
Equipment. With controlled-circulation boilers one expansion drum, Fig. 3, adequately handles output and return from a battery of any number of boilers. No other connection is needed.



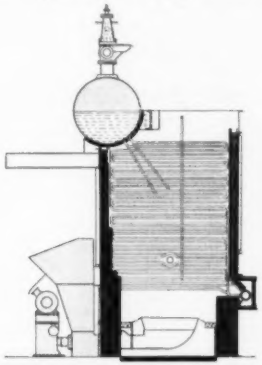
3 **TYPICAL APPLICATIONS** for h-p h-t hot water in industrial plants. Piping arrangement shown is diagrammatic and is to be used only as a guide for correct design. Important tips on equipment selection and application are given in the text



4 **ENERGY DISTRIBUTION** in an industrial steam plant shows the losses



5 **ENERGY LOSSES** are less in process plant using superheated water system



6 **CONTROLLED - CIRCULATION** boiler supplies h-p h-t hot water for system

Controlled-circulation boilers take least floor space. Combustion chamber is fully watercooled by horizontal coiled tubes over which is imposed a convection bank. High furnace heat-release rates are possible without tube failure because circulation is positive and controlled.

Circulating pumps, Fig. 3 and 7, are placed in the supply line. They keep system pressure high enough to prevent flashing. Bypass between supply and return allows some of return water to mix with water going to pump. This prevents flashing in suction by keeping system pressure up.

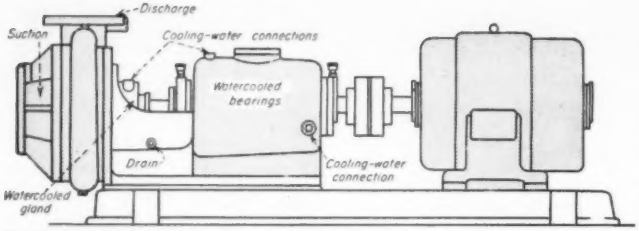
Use only pumps designed for h-p h-t systems if you want best results. Close-grained cast-iron is used in casing for pumps developing 150 psi or less. Above 150 psi, casing is cast steel. Bearings, stuffing box and gland flange are watercooled on pumps of all pressure ratings. Suction is shaped to avoid sudden flow and velocity changes and to reduce cavitation.

Base pump capacity on total Btu load of system, using density and specific heat of water at working temperature. Figure pump head from friction loss in the *index* circuit, which is the longest supply and return run of system. Add boiler, equipment and fitting resistance to this head.

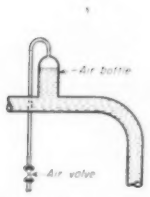
Two pumps are best for plants with normal heating load. Use three where load fluctuates widely. With two or three only one need be run for light loads and during mild weather. If there's danger of a power failure use one motor-driven, one turbine-driven.

Piping. H-p h-t water is easier to distribute than steam, especially for long runs. Since there's no need for condensate drainage, pipe is run to follow ground contours and take advantage of supports plant structural members offer. Access pits for underground lines are unnecessary.

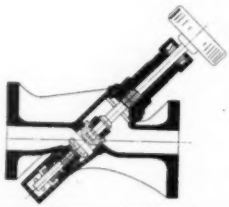
Piping Design. Frictional resistance of circuits, maximum operating head of pump, and design temperature drop of system are the three important points to consider. Usual plants have friction



7 **CIRCULATING PUMP** for h-p h-t hot-water system must be specially designed to withstand high temperatures. Bearings and glands in this unit are watercooled



8 **FIT AIR BOTTLES** to high points of piping system, dirt pockets to low



9 **REGULATING VALVE** for h-p h-t water system has a low friction head

HOW STEAM AND H-P H-T HOT WATER STACK UP FOR HEATING

Press. psia	Temp F	Density, lb per cu ft Water	Density, lb per cu ft Steam	Total heat, Btu/cu ft Water	Total heat, Btu/cu ft Steam	Heat ratio Water: Steam
14.7	212	59.8	.0373	10,760	42.9	251.0
25	240	59.2	.0573	12,320	66.5	185.5
35	259	58.6	.0796	13,320	92.9	143.5
45	274	58.3	.1063	14,170	124.7	113.5
55	287	57.8	.1285	14,800	151.0	98.0
65	298	57.5	.1502	15,360	177.0	86.8
75	308	57.2	.1720	15,840	203.3	78.0
85	316	56.8	.1938	16,260	229.4	71.0
95	324	56.6	.2152	16,670	255.3	65.4
105	331	56.4	.2365	17,000	281.0	60.5
115	338	56.1	.2580	17,320	306.5	56.6
125	344	55.8	.2790	17,600	332.4	52.9
135	350	55.6	.3005	17,870	357.8	50.0
145	356	55.5	.3215	18,170	383.8	47.4
155	361	55.2	.3430	18,380	410.0	44.8
165	366	55.0	.3635	18,610	434.0	43.0
175	371	54.8	.3850	18,830	461.0	40.0
185	375	54.6	.4060	19,040	486.0	39.2
195	380	54.5	.4270	19,220	511.0	37.7
205	384	54.3	.4480	19,400	537.0	36.2
215	388	54.1	.4690	19,570	562.0	34.8

head of 0.03 ft per ft of run. This allows the most economical pipe sizes and water velocities. Friction heads to 150 ft are common in h-p h-t hot-water systems.

Design temperature drop of system can be as low as 80 F or as high as 140 F. High drops permit smaller pipes but create other problems.

Size branch supply and return lines similarly to mains but use a friction head of 0.03 to 0.08 ft per ft of run. These values are offered only as guides; don't use without first studying your job completely.

Use welded piping except in boiler house where flanged valves are better. Fit enough valves to supply and return lines so sections can be isolated with or without ring mains. Have insulation thick enough to prevent excessive heat losses, whether lines be above or below ground. In well-installed systems temperature drop from radiation is less than 3 F per mile.

Pipe size is important in h-p h-t plants because two pipes of equal size, one for supply, the other for return, are used. Pick system temperature drop first, pump head or index-circuit pressure drop next and, last, loads on the circuit. Make every effort to keep pipe size within economical limits for the job. Remember, this is the deciding factor with h-p h-t hot water. In steam systems pressure drop is the deciding factor.

Temperature drop directly affects system first cost. For example, if 1 million Btu are to be transmitted through a mile of pipe with a 50-F drop and a velocity of 4 ft per sec, 2½-in. diameter pipe is needed. But if temperature drop in same system is 120 F, only a 1½-in. diameter is needed.

To transmit 10 million Btu with a 50-F drop a 6-in. pipe is necessary. Increase drop to 120 F and pipe diameter goes down to 4 in. When insulation, conduit wrapping, valves, excavation, expansion loops and other items are included, it is easy to see how good design reduces costs.

Pipe Protection. Prefabricated presealed insulated-type units are best for underground lines. Neither pipe nor insulation takes any ground load. Presealing gives maximum moisture resistance. Alternative is elaborate tunneling or concreting—an expensive, difficult structural problem.

Select pipe anchors large enough to withstand vibration and shock loads. Make allowance for pipe expansion and contraction. You are sure to meet this problem in h-p h-t systems because fluid temperature is high. Take advantage of changes in pipe direction by designing offsets in lines entering buildings. Use expansion loops or joints at proper points to absorb pipe movement.

Water Treatment. Since h-p h-t circuits are completely closed there should be no water loss except a small amount at valve glands and other packed joints. Padlock drains so employes can't bleed hot water for washing or other work that can be done with domestic water. Install air bottles, Fig. 8, at high points. Run air line down to a point near the floor so valve is easily reached. Fit dirt pockets to low points in line, Fig. 8.

By keeping system air-free and tight you'll step up efficiency considerably. Difference between steam and h-p h-t hot-water systems is in part the lower losses in the latter.

Makeup to efficiently operated h-p h-t systems is nil. No feed treatment is needed, corrosion is unknown.

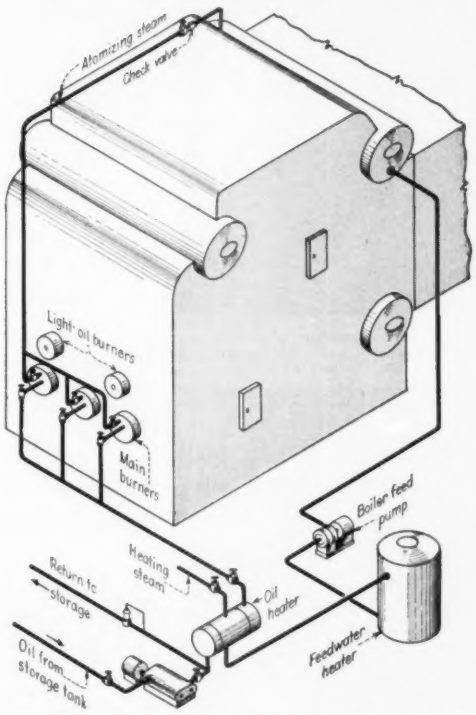
Rx Could You Cure This Headache?

▶ **The fine balance between power-plant circuits can play hob when ignored . . .**

▶ **Example of why emergencies must be met calmly to avoid a worse mess . . .**

Case No. 9— THE OIL-FILLED BOILER

By D C SWIFT, *Ebasco Services Inc*



PERFECTLY WORKABLE oil firing layout depends on intelligent operation and adequate maintenance to stay troublefree

▶ THE CHIEF ENGINEER of a good-sized power plant found himself, one cold winter morning, with an oil-filled boiler on his hands. The worst of it was that he didn't know exactly how the upper drums became one-third full of heavy bunker-C fuel oil and all the tubes thoroughly coated with the dirty stuff. As soon as one of his firemen reported the boiler had a waterglass full of oil, he ordered the unit off the line, even though a lot of steam was needed to meet the cold-morning load.

He prevented a possible boiler explosion, but almost all the front tubes in the steaming bank of the boiler were already bagged. An inspection showed the whole inside of the boiler a black, gooey mess of oil. Even the furnace and fireside of the tubes were oily and sooty.

Plant Setup. The eight boilers in the plant had all been coal-fired but when coal prices rose and oil prices fell, four of them were converted to oil burning. The oil-fired units were ordinarily banked overnight, while the coal-fired boilers carried the light night load.

Two motor-driven positive-displacement pumps supplied oil from the storage tank through a heater-strainer assembly. Small heaters at the underground-storage tank outlets heated oil flowing to the pumps to about 100 F. Pumps then forced the oil at high pressure through the tubular oil heater and the oil headers to the steam-atomizing type burners.

A pressure-relief valve allowed enough oil to return to storage to keep a steady 175-psig at the heater inlet. A thermostatically controlled steam valve held oil temperature at 200 F. Heating steam came from an auxiliary header. Atomizing steam came from the rear drum of each boiler through a small steam connection. Each boiler supplied its own burners.

A light-oil system with separate piping and burners fired off cold boilers until the furnace was hot enough to burn the heavy oil without smoke, and steam became available for atomizing. Main steam pressure was carried at 225 psig with drum pressure ranging up to 235 psig, depending on load.

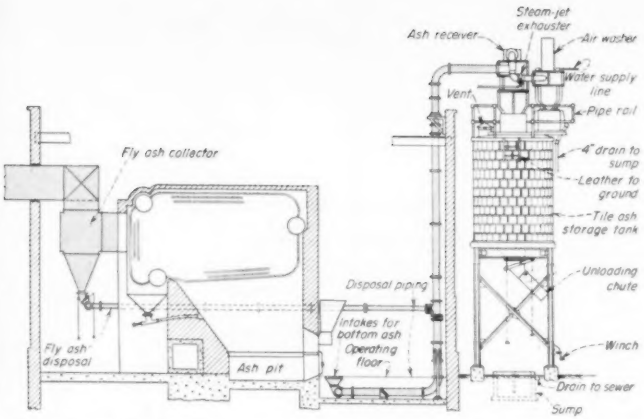
Investigation. There was no evidence of oil in any of the other boilers or the open feedwater heater to which the condensate from the oil heater was trapped. While the oil-filled boiler was cleaned up and bagged tubes replaced, a good deal of thought was given to how so much oil could get into only one boiler so quickly.

Check valve at the drum in the atomizing steam line was found full of oil and stuck partly open. Apparently the oil had come that way. But how could 175-psig oil work its way back into a 230-psig steam drum? A review of steam-pressure charts for the "day when the oil came" showed header pressure had been low for almost an hour at store-opening time.

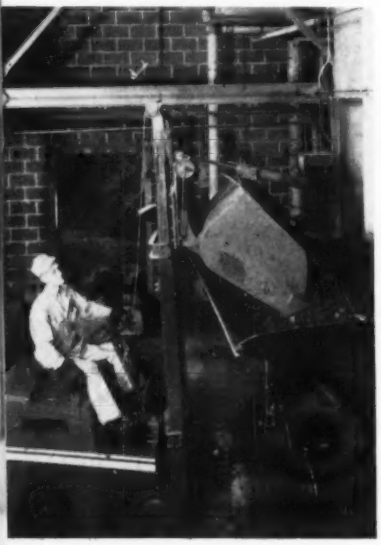
It was a cold, dark morning and the load had grown suddenly, dropping header pressure to about 150 psig. Operators were slow in getting the boiler heated up and into service. And then it didn't come up well and had been smoky. Burners hadn't atomized well either. Finally a second oil-

(*Continued on page* 214)

1 Simple monorail-hoist gives you very low-cost coal- and ash-handling setup

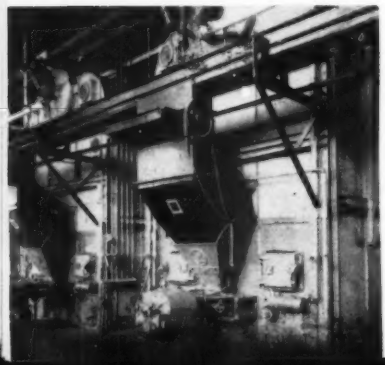


2 Pneumatic ash-handling arrangement can remove flyash from dust collectors and at the same time take care of bottom ash from the ashpit without dust problem



5 Familiar lift truck with bucket of about 750-lb size proves good tool

6 Highly modern coal and ash system pays its way in a medium-size plant



ROUNDUP OF TYPICAL INSTALLATIONS GIVES MONEY-SAVING POINTERS THAT SHOW...

The Way to Low-Cost Coal and Ash Handling

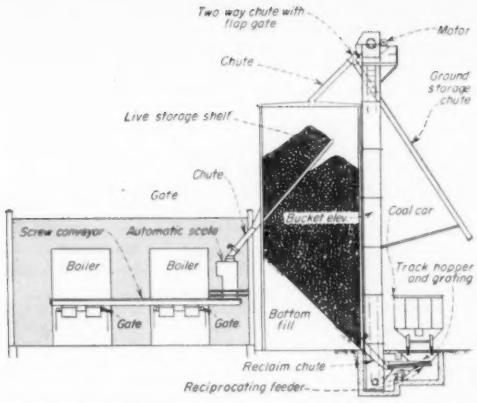
By **CARL A MARSHALL** *Director, and*
DONALD M GIVEN, *Fuel Engineer, Fairmont Coal Bureau*

► A CLOSE LOOK at coal- and ash-handling equipment on the market (POWER, April 1952, p 86) reveals that coal can give you the clean, labor-saving convenience of its competitors. What's more, the costs make sense to the small-plant operator.

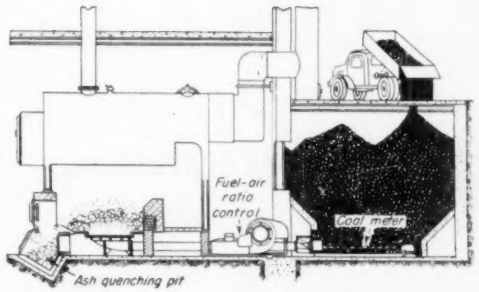
Typical Systems. Here are a number of setups that prove the point. Installed costs in some come below $5000. All equipment is as sturdy and reliable as you can get. Yet their total costs—investment, operating, maintenance—range between 50c and $1.00 per ton coal consumed.

A simple monorail-hoist system like Fig. 1 (Detroit Hoist & Machine Co) can be put in for $600 to $900. Operator pushes the wheel-mounted coal-and-ash bucket (good for up to 700 lb) to the coal pile; loads it by hand, or by gravity if it's an elevated bin; wheels it to the boilers; hoists it; moves it over the hoppers; dumps it. By limiting the monorail to a run over the hopper only, you avoid elaborate layouts and any need to electrify the track. Be sure bucket capacity is large enough to keep average loading down to about two trips per hr. This way you won't interfere with other boiler-room duties.

The familiar lift truck with scoop bucket of about 750-lb capacity, Fig. 5 (Clark Equipment Co), costs $2800 to $3300. It scoops up coal from a pile inside or out and delivers it direct to



3 This pushbutton handling of coal from the track to stoker hopper with integral storage silo has a wide application



4 Simple enclosed conveyor, screw or flight type, offers you laborless and dustless coal feeding from bin to hopper

stoker hoppers. Ashes are handled the same way.

If the pile is outside, you'll find pneumatic-tired models have lower tire maintenance, give better traction. They cost about $3700 with a 1000-lb bucket, and $4500 with 2000-lb capacity. You can increase stoker hopper capacity easily to handle a full-bucket load where necessary.

The simple enclosed conveyor, screw or flight type, Fig. 4 (Iron Fireman Mfg Co), offers laborless and dustless coal feeding from storage bin to stoker hopper. Use one conveyor for two hoppers if you want to. Total erected costs, not including storage bin, reach $800 to 1500 per conveyor depending on length and diameter. Slow-speed operation and surplus capacity pay off for screw-type conveyors in lower maintenance costs. For another $80 per conveyor, install coal-limit switches to make conveyor operation automatic.

Automatic Systems. Pushbutton handling of coal is definitely here. There are a number of systems, such as the one in Fig. 3 (Gifford Wood Co). Silo storage aids in flexible, low-cost handling. Bucket elevators deliver coal onto the silo live-storage shelf (or ground storage, if you want). Excess coal spills over into reserve and is later reclaimed with the bucket elevator to live storage. This storage space delivers coal in turn to automatic scales and then by screw conveyors to stoker hoppers.

A portable car-unloading system in place of undertrack hopper and feeder above saves at least $3000.

Instead of a silo you can go to a cylindrical bunker if space limitations favor storage on the boiler-house roof. A weigh larry or monorail bucket can substitute for screw-conveyor feed to the stoker hoppers. Some plants get away with simple gravity chutes from the silo. The choice is highly individual, but let storage for an efficient, clean, low-cost job dictate your decision.

Remember, conveyor capacities from track to silo control rate you unload a car. For small plants a 25-ton-per-hr unit works well. It unloads a 50-ton car in about two hr. For a plant burning 20,000 to 30,000 tons per year a 50-ton-per-hr conveyor is in order. But excessive conveyor capacity substantially increases investment costs.

Silo Operation. Usually silo size ought to be equivalent to a one-week supply of coal and never less than 100 tons. Then you eliminate the need to draw from ground storage except in emergency. You avoid extra labor charges and troubles that come from disturbing the storage pile. Most wet-coal complaints have their beginnings in this movement from ground storage to plant.

Concrete stave silos serve the small plant best. Their cost runs much less than any other storage unit. Tile silos cost twice as much. Steel bunkers average four to five times as much on an erected basis for equivalent capacity. Cylindrical steel bunkers are used when there is not enough space for silos. Suspension bunkers are usually a poor selection. They require extra boiler-room space and often cause dust and other inconveniences.

A word of caution about silos. Live-storage shelf should hold a one-day supply. This is large enough to let you repair any bucket-elevator troubles without shutdown and small enough for operators to recirculate coal often from reserve-storage space. Recirculate as often as necessary to prevent silo fires—usually about 30 to 40% each week. Also, silo must have a sloping bottom, and airtight gates at all openings below coal level.

Arching on the live-storage shelf depends on moisture in coal and slope of shelf (45 to 60 deg is recommended). You control moisture by making silo large enough to avoid frequent drawing from ground storage.

Any silo can be designed without live storage if it is raised high enough for satisfactory conveying from silo bottom, or if an extra chute goes in at top of bucket elevator for direct feeding to a separate bunker of about 8-hr storage capacity.

Coal Weighing. For the usual small boiler plant not equipped with steam-flow meters you may not need scales. Weekly or monthly estimates of coal-level change in a silo compared with deliveries gives you a close enough check on average efficiency.

Ash Handling. Usual coal-handling conveyor suffers under the abrasive action of ash when you try to make it do both jobs. If it comes to a choice between coal- or ash-handling equipment, pick coal. There's more of it to handle.

Really small plants can get by with hoist buckets or other portable equipment for ash handling. Pneumatic or hydraulic sluicing systems start around $12,000 installed. If no fill area is

(*Continued on page 218*)

LET'S END THIS CONFUSION...

MAKE LAB TESTS BASE FOR...

STANDARDIZED SPECS TO...

Straighten Out Lube Purchasing

To keep tab on lubes by trade name, viscosity, pour and flash point, etc, is a big job. Here's a system that boils it down to code. It gives use, consistency, brand — is easy to handle

► CLASSIFICATION of industrial lubricants is vitally important when applied to modern high-speed precision machinery. Different machines need different lubes. Yet it's an almost impossible task to keep track of and schedule a hundred or so different lubes without some scheme for simplification.

This article won't debate the issue in making sense of classification. The subject is a controversial one, and the answers are hard to come by. It will, however, present the problem as it exists, and outline one method of classifying now used. Consider it a step in the right direction.

Lubrication is now a specialized branch of engineering involving mechanics and chemistry. In fact, the chemical composition of the gear lubricant of a cold reduction mill affects directly the designed length of the mill pinion and the bearing type. Thus, lubes can no longer be dubbed by such names as "dope, goo, or gunk."

Brand Names. When developing compounds, suppliers have used names that describe (1) lubricant type or (2) machine or application it's used for. A few that come to mind are:

1 Black oil	6 Cup grease
2 Engine oil	7 Fiber grease
3 Gear shield	8 Axle grease
4 Pinion grease	9 Neck grease
5 Cylinder grease	10 Block grease

Many of these names through years of use have become known as a type of lubricant. The newer brand names have found other means of unique nomenclature. For example:

1 Stars	6 Initials
2 Sea shells	7 Letters
3 Indian tribes	8 Machines
4 Geology	9 States or countries
5 Numbers	10 Pointless coined words

When you add the many brand names to the various viscosity, flash point, pour point, additive and application descriptions, to say nothing of brand serial or purchasing numbers, the only result is a mess unless you have a system.

The automotive industry represented by the Society of Automotive Engineers realized the problem at hand. It set up the SAE numbering system, which identifies motor oils' viscosity by numbers without reference to quality (see Tables I and II).

Grease manufacturers also saw the problem. The National Lubrication Grease Institute Standards state grease consistency numbers without stating quality (see Table III).

Many suppliers include these consistency standards in their brand names because they are common yardsticks easily followed by the user. Many have also added formula numbers, brand numbers or other numerical identification to insure positive clarity and description of their product.

Large users of lubricants have the same problem of clarity. Many have their own system of identification such as: Lubricant #1, an oil of a specific type for a specific use. Lubricant #2, an oil of a different type for a different use. Greases of various types and applications have similar identification. This simplifies record keeping and avoids confusion caused by trade names having no meaning in connection with their application.

United States Steel Corp. uses a more elaborate classification system. Code numbers reveal use of brand-name product without revealing details of their analysis. To meet larger consumer needs such a system has four general requirements to fill:

1. It must be adaptable to IBM (International Business Machines) for correlation to other codes in recording various statistics.

2. It must have listings arranged by similar types of mate-

rials and by increasing or decreasing grades of consistency.

3. It must cross index 4000 products supplied by more than 100 companies to 65 plants.

4. It must indicate possible substitutions from alternate sources in emergencies.

Since the system U.S. Steel uses is designed to meet these requirements, we'll describe it further.

Mineral oils measured at 100 F ssu (Saybolt seconds universal). The first 2-digit number denotes class or type of lubricant as stated in the following listings. The three digits following the first dash give viscosity at 100 F in 10-second units (multiply number by 10 to get true viscosity). Last two digits are the number for a particular brand name product. Unused numbers allow expansion for products not yet developed:

Straight engine oil 11-000-00
This class is a once-through oil, as used for hand oiling, without any extra processing.

Mineral circulating oil with additives 12-000-00
Highly refined oil for circulating systems. Has one or more additives for stability and metal protection.

Nonadditive circulating oil 13-000-00
Refined oil for circulating systems but without additive compounding.

Internal combustion-engine crankcase oil 14-000-00
Including diesel and automotive additive oils.

Process and protective-coating oils 15-000-00
Includes special compounds for processing and corrosion protection during shipment and manufacture.

Soluble and cutting oils 16-000-00
Metal working, machining and treating lubricants.

Special oils at 100 F 19-000-00
All miscellaneous specialty products with unique properties but having a consistency in range of Saybolt instrument at 100 F.

Mineral oils measured at 210 F ssu. The sequence of numbers is the same as for the first table except that viscosity is given at 210 F in 1-second units by the three middle digits (true viscosity).

Uncompounded cylinder oil	20-000-00
Compounded cylinder oil	21-000-00
Extreme pressure fluid compounds	22-000-00
Residuum gear shields, all black oils	23-000-00
Special oils at 210 F	29-000-00

Greases measured by ASTM penetration. The same procedure applies for this group except that the three middle digits give direct reading of ASTM penetration.

Calcium soap greases	30-000-00
Soda soap greases	31-000-00
Mixed base greases	33-000-00
Graphite compounding	34-000-00
Extreme pressure grease	35-000-00
Barium or lithium grease	37-000-00
Open gear grease	38-000-00
Special grease	49-000-00
Block grease	50-000-00
Asphalt and road oil	60-000-00
Products not otherwise specified	70-000-00

Special products classification. If the product cannot be measured within the limits of Saybolt viscosity or ASTM penetration, the arbitrary numbers 000 to 005 are used following the first dash to indicate no consistency reference.

When viscosity is greater than 990 ssu at 210 F, the numbers 991 to 999 give consistency with the third digit reading in thousand second units.

I: SAE LUBE CLASSIFICATION

SAE Viscosity Number	Viscosity range, ssu — At 0 degrees F Min	At 0 degrees F Max	At 210 degrees F Min	At 210 degrees F Max
5W	—	4,000	—	—
10W	6,000	under 12,000	—	—
20W	12,000	—	—	—
20	—	—	45	under 58
30	—	—	58	under 70
40	—	—	70	under 85
50	—	—	85	110

II: TYPICAL SAE VISCOSITIES, SSU

SAE	100 F	210 F
10W	202	48
20W	323	57
30	538	68
40	850	84
50	1174	100

III: NLGI GREASE CLASSIFICATION

NLGI number	ASTM worked penetration units
0	355 – 385
1	310 – 340
2	265 – 295
3	220 – 250
4	175 – 205
5	130 – 160
6	85 – 115

That's how the system sets up. Now let's look at examples of some probable lubricants you'd use.

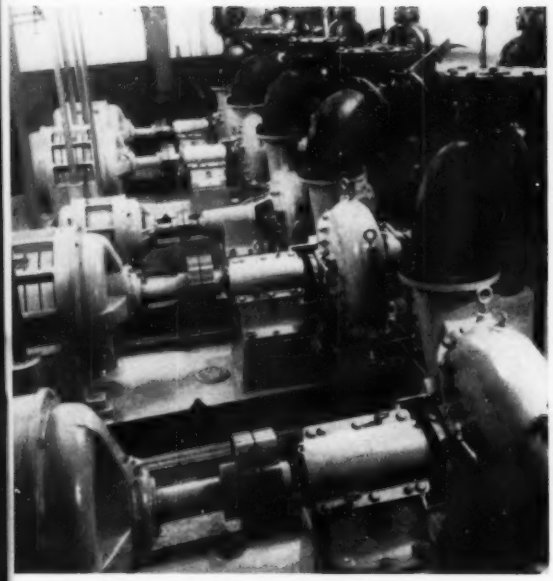
ABC oil, SAE 10 W	14-021-42
XYZ cylinder oil	21-175-45
EP grease O	35-360-47
High-viscosity oil	23-995-46
Special-product oil	19-001-43

To this designation is added a purchasing statistic code, like this:

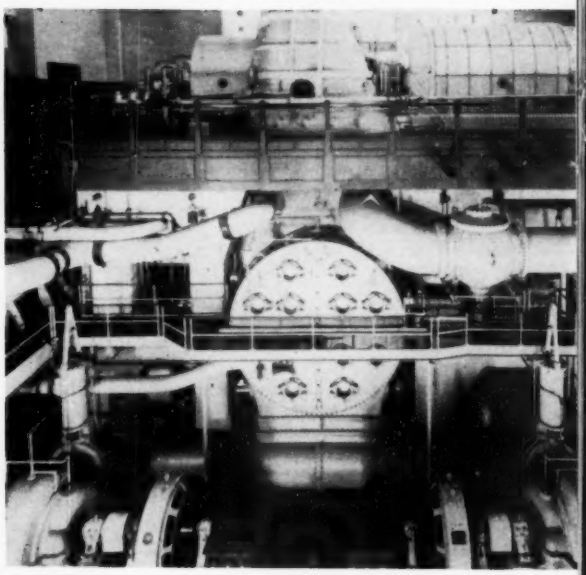
ABC oil, SAE 10 W	14-021-42	11516
XYZ cylinder oil	21-175-45	11512

This system satisfies all the conditions stated. Use of IBM simplifies mechanical sorting for listing all lubricants by type under major or minor control. And above all, this method coordinates lubricant classification, yet does not interfere with either specification or brand name of products.

Basic information in this article was taken from ASLE paper, "Classification of Industrial Lubricants," by Charles A. Bailey, lubrication engineer, National Tube Div of U.S. Steel. This paper was presented before the ASLE annual meeting in Cleveland, April 1952.



SEWAGE pumping station has pumps with individual suction connections, common discharge header. The capacity varies



CONDENSER circulating pumps are often installed in duplicate to run in parallel and discharge through common header

Use Characteristic Curves to Boost the

You can run similar or dissimilar pumps on nonthrottled systems if the units are properly selected. Here are practical tips for analyzing your pumping job and picking the best pump

By **ROY CARTER** and **IGOR J KARASSIK**, *Application Engineers, Worthington Corp*

► CENTRIFUGAL PUMPS may have to run in parallel on two types of systems: throttled and nonthrottled. On a throttled system, pump capacity is regulated to suit demand by a throttle valve or other device. Such systems were described in April POWER, p 82. On nonthrottled systems, discussed here, capacity delivered is that at which developed head of pump equals system head (static head plus friction).

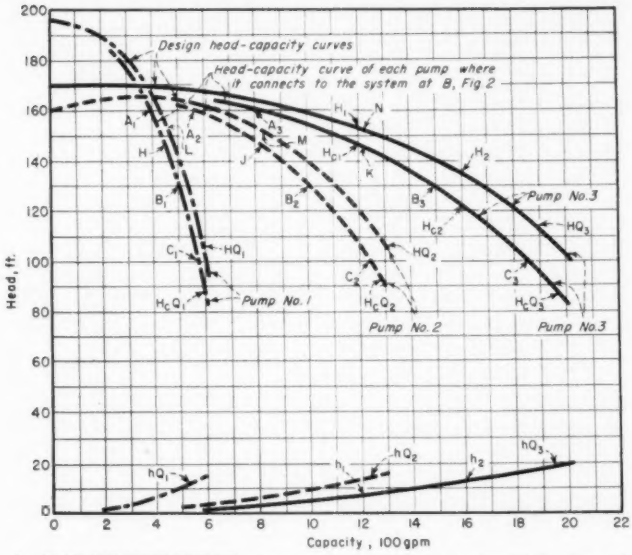
Characteristics. On a nonthrottled system pumps of similar or dissimilar characteristics can run in parallel without trouble on most jobs. To do so, system head must not exceed shutoff head of any pump at any capacity that can be produced by the combination of other pumps delivering into the same system.

Three in Parallel. Take, as an example, the three pumps with head-capacity curves HQ_1, HQ_2, HQ_3, Fig. 1. Assume they operate on the system in Fig. 2, each pump having separate piping and valves to point B. As the pumps differ in size, head losses from A to B are generally different for each size. Also, since they have different characteristics, operating two or three in parallel causes their capacity to change as system head changes. So when combining pump characteristics you must use net characteristic of each pump measured from A to B. Also compare it with the net system characteristics including friction losses only from B to reservoir.

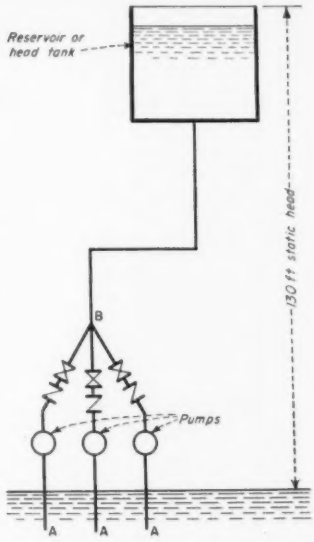
Shown at bottom of Fig. 1 for each pump are friction-head loss curves hQ_1, hQ_2 and hQ_3 from A to B. Head produced by each pump measured from A to B for any capacity is the head shown on its HQ curve less that on the hQ curve at the same capacity. For example, pump No. 3 at 1200 gpm develops 153-ft head, point H_3, as measured from its suction to discharge nozzle. Friction loss on curve hQ_3 at 1200 gpm is 7 ft, point h_3, so head available to overcome the system head common to the three pumps is 153 − 7 = 146 ft, point H_{e3}.

At 1600 gpm, No. 3 is good for 135-ft head, point H_3, and friction loss on curve hQ_3 is 12 ft, point h_3. Then, head available to discharge water into the reservoir against the system head is 134 − 12 = 122 ft, point H_{e3}. In this

CENTRIFUGAL PUMPS PARALLELED ON NONTHROTTLED SYSTEMS MUST BE CAREFULLY CHOSEN


Design head-capacity curves
Head-capacity curve of each pump where it connects to the system at B, Fig 2
Pump No.1
Pump No.2
Pump No.3
Head, ft.
Capacity, 100 gpm

1 **HEAD-CAPACITY CURVES,** also piping and valve friction-head loss curves, for three centrifugal pumps with dissimilar characteristics. Used in system study



2 **THREE PUMPS** connected in parallel on nonthrottled system with reservoir

Pumping Economy of Nonthrottled System

way the other points can be located to draw curve H_cQ_s. Plot curves H_cQ_1 and H_cQ_2 by same method.

Since friction losses increase with capacity, H_cQ curves are steeper than HQ curves. With lower head pumps for which friction loss in the piping of each pump is a larger percentage of the total head, the H_cQ curve may rise steadily to shut off although the HQ curve is slightly drooping.

System Characteristics. Fig. 3 shows system characteristics SS, with losses from A to B, Fig. 2, excluded. This is the 130-ft static head plus friction losses from B to reservoir, which increase with flow, starting at 130 ft, point S, for zero flow.

Also plotted on Fig. 3 are the H_cQ curves of pumps 1, 2, 3, identified as in Fig. 1 as H_cQ_1, H_cQ_2 and H_cQ_3, and their combined H_cQ characteristics. Like any combined head-capacity curves these are found by adding capacities of the pumps at the same head. This gives capacity of the combination at several heads, and a curve is drawn through the plotted points.

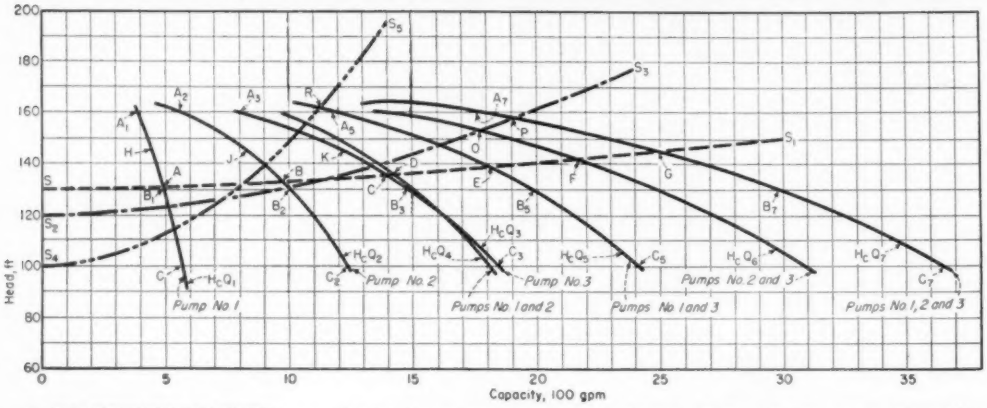
For example, for heads measured from A to B pump No. 1 will deliver 387 gpm at 160-ft head, 497 at 130-ft head and 572 gpm at 100-ft head, points A_1, B_1 and C_1, respectively. No. 2 handles 565 gpm at 160 ft, point A_2, 1000 gpm at 130 ft, B_2, and 1238 gpm at 100 ft, C_2. No. 3 discharges 800 gpm at 160 ft, point A_3, 1480 gpm at 130 ft, B_3, and 1845 gpm at 100 ft, C_3. These values are also identified by the same symbols on curves H_cQ_1, H_cQ_2 and H_cQ_3 in Fig. 1.

If No. 1 and 3 operated in parallel, combined capacity would be 387 + 800 = 1187 gpm at 160-ft head, point A_5; 497 + 1480 = 1977 gpm at 130-ft head, point B_5; 572 + 1845 = 2417 gpm at 100 ft, point C_5, curve H_cQ_5, Fig. 3. Similarly if the three pumps operated in parallel, their combined capacity would be 387 + 565 + 800 = 1752 at 160-ft head, point A_7, 497 + 1000 + 1480 = 2977 gpm at 130-ft head, point B_7, and 572 + 1238 + 1845 = 3655 gpm at 100-ft head, point C_7 on curve H_cQ_7, Fig. 3. Head-capacity curves H_cQ_4 and H_cQ_6 for No. 1 and 2 and No. 2 and 3 operating in parallel can be plotted in a similar manner.

Points at which the different H_cQ curves cross the system head curve SS, indicate the capacity that each pump or combinations of pumps will deliver and also the net system head against which they will be operating. Thus No. 1 operating alone will deliver 495 gpm at 131-ft head, point A. No. 2 will discharge 975 gpm at 133-ft head, and No. 3 1390 gpm at 135-ft head, points B and C respectively. When they operate in parallel, No. 1 and 2 will discharge 1420 gpm against 136-ft head, point D; No. 1 and 3 at 138-ft head 1810 gpm, point E; No. 2 and 3 at 142-ft head 2160 gpm, point F; No. 1, 2 and 3 at 145-ft head, point G, 2500 gpm.

Pump Capacity. To find what capacity each pump delivers you refer to its H_cQ curve at the operating head. For example, No. 1, 2 and 3 together discharge 2500 gpm against a head of 145 ft as measured from A to B, Fig. 2. From the H_cQ curve of Fig. 3, we find that No. 1 supplies 450 gpm, point H; No. 2 supplies 835 gpm, point J; No. 3 supplies 1215 gpm—all at 145-ft head, point K. These values are also identi-

HEAD-CAPACITY AND SYSTEM CHARACTERISTIC CURVES ARE YOUR KEY TO PUMP OPERATION



3 **CORRECTED HEAD-CAPACITY** curves, H_cQ, for three pumps, Fig. 1, superimposed on the system characteristics of a water system. Operation is shown for the pumps when working as single units and in combinations of two and three units

fied on the H_cQ curves in Fig. 1. It also shows on the HQ curves that the head the pumps develop from suction to discharge nozzle is 153 ft for No. 1, 151 ft for No. 2, and 152 ft for No. 3, points L, M and N, respectively.

Different Systems. Head of most nonthrottled systems consists of a large static component with a relatively small friction component at maximum pumping capacity such as curve SS_1, Fig. 3. On this system the total operating-head range is roughly 140 to 153 ft. Curve S_2S_6, Fig. 3, shows a system with 10-ft less static head and greater friction head than SS_1. The steeper system head results in less increase in capacity when another pump is added. For example, going from a condition with No. 2 and 3 in service to all three running increases delivered capacity from 2170 to 2500 gpm or 330 gpm, points F to G on system curve SS_1. On system S_2S_6 capacity increases from 1765 gpm, point O to 1915, point P, or 150 gpm compared to 330 gpm on system SS_1.

We mentioned that pumps of dissimilar characteristics can operate in parallel if system head does not exceed shutoff head of any pump at any capacity produced by a combination of other pumps on the system. If the three pumps, Fig. 1, are on a system with the head curve S_4S_5, Fig. 3, No. 1 and 3 together can deliver 1120 gpm, 162-ft head, point R. No. 2, if started, cannot discharge into the system as its shutoff head is only 160 ft, Fig. 1. Thus for system S_4S_5, parallel operation will be limited to two pumps, never all three. Also, at 162-ft head, No. 2 and 3, operating in parallel on system head S_4S_5, have practically the same capacity as No. 1 and 3.

Friction Systems. Head on a condenser circulating-water system is nearly all friction. Such a system generally uses two equal-capacity pumps. Both are in service in summer when water temperatures are high, and one in winter when they are low. Fig. 4 shows, without going into details of how the system head curves were developed, the results obtained with two duplicate pumps on a circulating-water system. Single pump operation gives 2140 gpm at about 18-ft total head, point A, while two-pump operating capacity is 3200 gpm at 25-ft head, point B. With these pumps and system characteristics, capacity increase is only 3200 – 2150 = 1050 gpm, or less than half of one pump operating alone.

For convenience, when quoting on several duplicate pumps in parallel, manufacturers show on their proposal curve of the individual pump characteristic, system-head curves plotted against pump capacity, Fig. 5, instead of giving curves as in Fig. 4 where single and two-pump characteristics are plotted against system capacity. Either method shows results that can be obtained, but Fig. 5 indicates the efficiency and horsepower for single- and two-pump operation in simpler form.

Pump Selection. When a number of pumps operate on a nonthrottled system, they are often purchased for capacities and total head corresponding to that at maximum demand. For example, in the system in Fig. 2, whose characteristics less losses from A to B are curve SS_1 Fig. 3, 3000-gpm delivery with all pumps running might be desired. This would require pumps giving a total of 3000 gpm against 150-ft head plus losses from A to B. This would approximate 10 ft, so pumps for a 160-ft total head would be purchased.

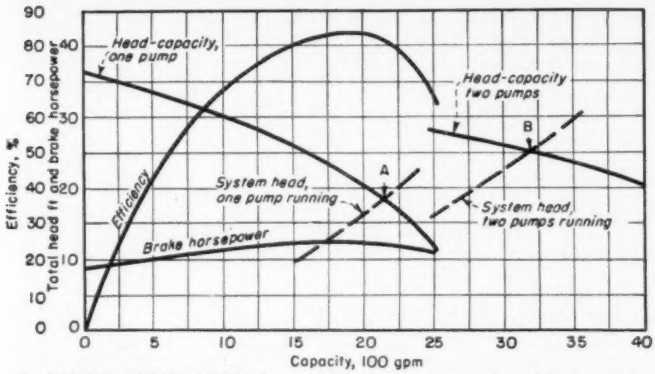
In such a system, demand might be constant or vary over a narrow or wide range. As a result, selection of a number of pumps and their individual ratings would depend on these factors. In selecting the pumps watch several points if the head changes when fewer units are in service.

1. Select driver sizes for power required over head range on which the pumps will operate.

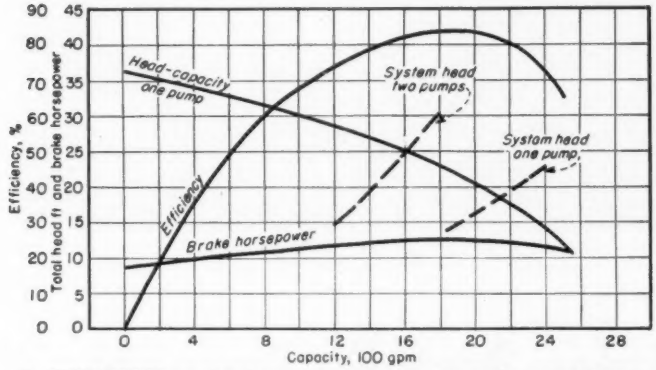
2. If considerable operation will be at reduced capacity with resulting reduced total head, select the pumps so maximum efficiency is at the average operating heads. As an example, take a pump for 1200 gpm at 143-ft head to be used with others on a system where operating head ranges from 120 to 143 with 135-ft as average. Pump in Fig. 6 would be an ideal selection with good efficiency at high- and low-head points A and B and maximum efficiency roughly at 135 ft.

3. With reduced total head a centrifugal pump delivers more capacity. This means less available net-positive suction head (npsh) because of increased friction in the suction line, causing reduced suction head or increased suction lift. However, with increased capacity, the pump requires more npsh. Take care that available

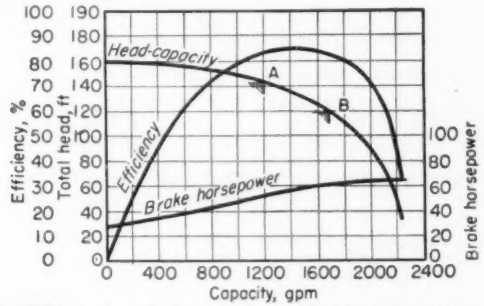
MANUFACTURERS ARE GLAD TO HELP WITH PUMP PROBLEMS



4 **CHARACTERISTIC CURVES** of two duplicate pumps run singly and in parallel to supply condenser circulating water. Head pumped against is largely friction



5 **SYSTEM HEADS** are plotted against capacity of one pump when a manufacturer quotes on duplicate pumps to run in parallel. This is done for convenience



6 **SELECT PUMPS** so best efficiency occurs at a head between maximum and minimum operating points when one of several units in parallel will be idle frequently

npsh at reduced head operating point, such as *B* in Fig. 6, equals or exceeds what the pump requires.

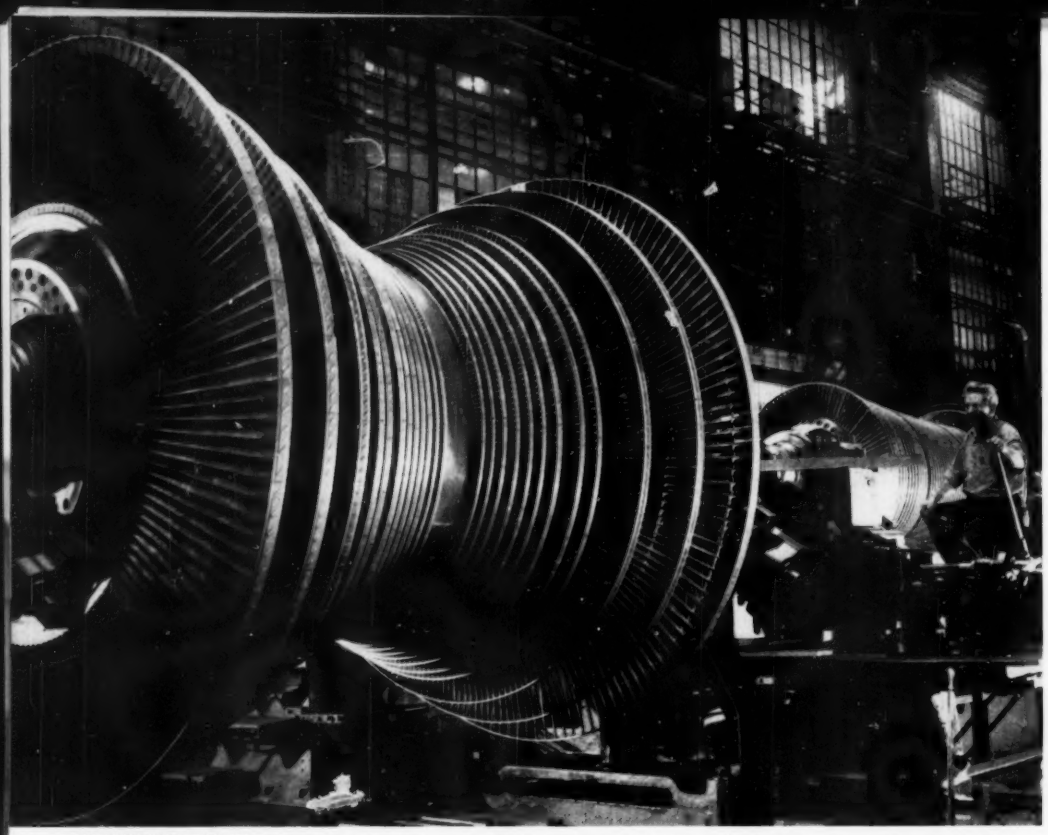
Existing Pumps, New Ones. Successful operation of two or more centrifugal pumps in parallel depends on characteristics of system and pumps. To determine if existing pumps are suitable to operate in parallel, you must know characteristics of pumps and system. Too often inquiries for new pumps give little or no information on either and yet the purchaser expects by some miracle to successfully parallel new pumps with old ones. Fortunately, most systems are not throttled, like Fig. 2, and have a fairly flat system-head curve like SS_1, Fig. 3.

Don't try to operate pumps in parallel without first analyzing the system. If it is complicated, submit complete data to the manufacturer even if you make your own analysis. If you slipped up somewhere in your calculations, it will save you a lot of trouble. If you are correct, you will have the pleasure of being told you understand your pumping needs. In any event you will be sure of getting the right equipment for the job, insuring satisfactory operation and not headaches.

Economic Considerations. This discussion of pumps operating in parallel on nonthrottled systems has been primarily concerned with hydraulic considerations. While parallel operation may often give the desired hydraulic results, it means operating the pumps over a wide head range with resulting poor efficiency at high or low heads, or both. This is especially true when the system head has a large friction component at the maximum demand. Systems that are nearly all friction often warrant using multi-speed pump motors or different-size pumps, each designed for a specific capacity and head for the system.

For example, instead of two pumps, Fig. 5, a single pump driven by a 900- and 600-rpm 2-speed motor would give 3200 gpm and 25-ft total head at 870 rpm; 2090 gpm and 18.5-ft total head at 580 rpm. While this would mean a saving of 3.7% in power it would likely not be justified economically. If one of two 1600-gpm pumps failed, a condenser could remain in service with the other pump even in summer, though the vacuum would be reduced. To obtain the same standby with the 3200-gpm 2-speed unit, a second 3200-gpm pump would have to be purchased, or a summer unit for 3200 gpm at 25-ft total head and 870 rpm, and a winter unit for 2090 gpm at 18.5-ft total head and 580 rpm.

In either case, total cost would be more than for two 1600-gpm units. As the heads are relatively low, so is the power. A higher efficiency that reduces power 3.7% means little saving in yearly operating cost, especially in a plant where power cost is low. Thus, savings probably would not be enough to justify the increased first cost for two 3200-gpm units. With higher head installations, reverse is expected.



TREMENDOUS VOLUME needed by exhaust steam at very low backpressures calls for longest possible blades in last stage of turbine. To make large capacity units, double-flow arrangements double the exhaust area to double steam flow

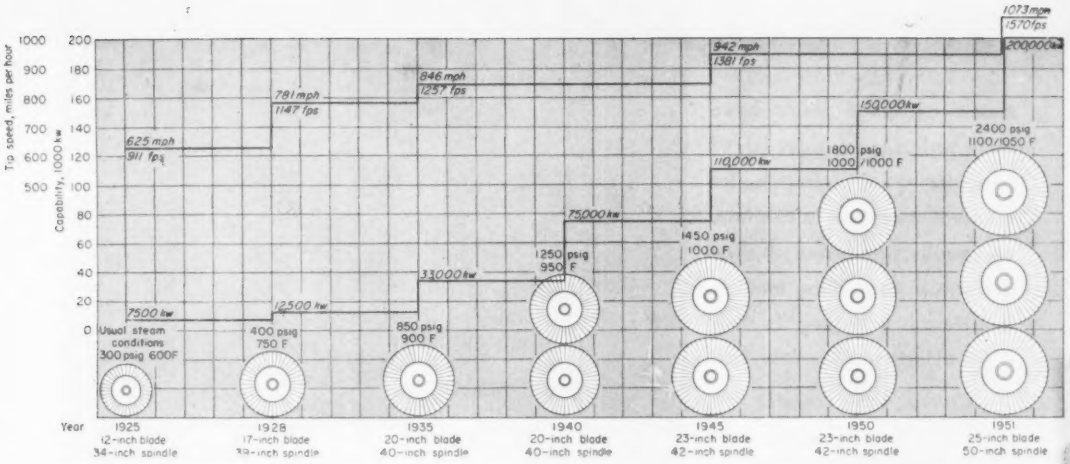
Turbine Blades Push Up Capacity

Every machine has limitations that fix its maximum output. In the steam turbine, size of last-stage blading controls amount of steam flow through the unit. Demand for more and more kilowatts per unit focuses the designers' attention on this bottleneck to produce bigger turbine-generators for growing America

By **JOHN R CARLSON,** *Manager, Turbine Application Section*
Steam Division, Westinghouse Electric Corp

► THE 25-IN.-LONG exhaust-row turbine blade for 3600-rpm machines marks a major step in steam-turbine development history. Though only 2 in. longer than the preceding maximum, this blade mounts on a wheel of 20% greater diameter giving 25% more steam-flow exhaust area. This means the maximum size of high-speed steam turbines has been increased one-fourth without increasing the leaving loss, the energy remaining in the exhaust steam on its way to the condenser.

Economic kilowatt rating of a condensing turbine depends on the exhaust-flow area. Hence engineers continually strive to build turbines with greater exhaust annulus. Larger exhaust annulus can be obtained by using multiplicity of exhaust ends or by reducing speed of rotation. By using blades of the same geometric proportion and with the same tip speed, reducing the shaft speed permits increasing the exhaust annulus. The table below compares single-flow turbines of different shaft speeds, all units having a common tip



GROWTH OF 3600-RPM exhaust-row blading started in 1925 with 12-in. long blade which now has grown to 25 in. Double flow construction was used in 1940 to meet demands for bigger units. Maximum size units now use triple-exhaust arrangement

speed of exactly 1257 feet per second:

Shaft rpm	*Rating, kw*	*Blade height, in.*	*Wheel dia, in.*	*Tip dia, in.*
3600	30,000	20	40	80
1800	120,000	40	80	160
1200	240,000	60	120	240

A 40-in. blade on an 1800-rpm turbine has about the same design problems as a 20-in. blade on a 3600-rpm machine. But the exhaust annulus with a lower-speed turbine is four times as great. Then why not a lower speed for all large turbines? Low-speed turbines are heavy, massive and hard to build for high pressures and temperatures. A 60,000-kw 3600-rpm tandem-compound turbine weighs 150 tons less than a single-case 1800-rpm machine. An 80,000-kw 3600-rpm turbine weighs 170 tons less than the slower-speed machine. For economic reasons alone, whenever longer exhaust-end blading has been developed for high-speed turbines it has marked the end of the slower-speed machine for that rating and below.

Materials. Development of longer blading would not be possible without high-strength material and methods of controlling blade vibration. About 30 years ago, steel companies developed with our cooperation present-day low-carbon 12% chrome-iron alloy, which is now virtually standard for turbine blading. This high-strength material can be easily rolled, machined and forged into proper blade shapes. It has excellent inherent qualities for damping vibrations.

Vibrations. Barring defective material or accidental contact, practically all blade failures can be attributed to resonant vibrations. These develop stresses beyond the fatigue limit of the material. Blades resonant with some harmonic of the turbine-shaft speed—60, 120, 180, 240, 300 or 360 cps—may vibrate at amplitudes high enough to overstress the material and cause failure. Important milestones were the methods developed for calculating natural resonant frequencies of blades and methods of detuning. Detuning involves proper design of the blade itself, use of shroud bands, lashing abutments and assembly of blades into groups.

Erosion by Moisture. Development of longer exhaust-end blading for 3600-rpm use has raised the need for protecting it against the erosive action of water. Even with relatively low peripheral speeds, early blades unprotected from moisture sometimes showed a disturbing amount of wear, sometimes during the first year. Present-day blades designed on free-vortex theory of flow and fitted with stellite shields and moisture-removal devices have effectively minimized erosive action of moisture. Present-day reheat turbines have a moisture content at exhaust about one-half that of non-reheat machines.

Maximum Ratings. Before the 25-in. blade, a turbine-generator of 200,000 kw was built either as a tandem-compound double-flow 1800-rpm unit or as a cross-compound 3600/1800-rpm unit with double-flow exhaust. For high pressures and temperatures the latter is always preferred.

By using three sets of these new long blades a 3600-rpm 200,000-kw turbine-generator can be built on a single shaft. Its efficiency with ordinary condenser cooling temperatures is only slightly poorer than that of the 1800-rpm machine, but its cost is considerably less.

For example, a 200,000-kw turbine-generator cross-compound machine weighs 2,750,000 lb compared with 1,500,000 for the single-shaft 3600-rpm machine. This results in a saving of 625 tons of steel-blade alloy, steel forgings, castings and copper. In these days of material shortages the saving of one and a quarter million pounds is of national significance. Single-shaft 3600-rpm turbine-generators are only a little longer than the cross-compound unit. They are much narrower. They need smaller cranes and lighter foundations. For example, the heaviest piece to be handled after erection of the 3600-rpm single-shaft turbine is 40 tons, compared with 125 tons for the low-speed cross-compound turbine.

The 25-in. blade is patterned after the 23-in., but is proportionally larger. Materials and stress levels are unchanged. Six years ago introduction of the 23-in. blade aroused much argument. By contrast, the 25-in. blade has been accepted almost without question—largely because of the flawless performance of its predecessor.

What comes next? Perhaps hollow blades (to keep down centrifugal forces) or blades made of some other material, such as titanium. Meanwhile the 25-in. blade will do nicely until someone wants more than a quarter of a million kilowatts from a single-shaft machine.

Anion-exchange resins have done such a spectacular job of removing the silica from boiler feedwater we tend to overlook an equally significant job they perform in controlling alkalinity. Here is how they do their work effectively, at low cost

By JOSEPH THOMPSON
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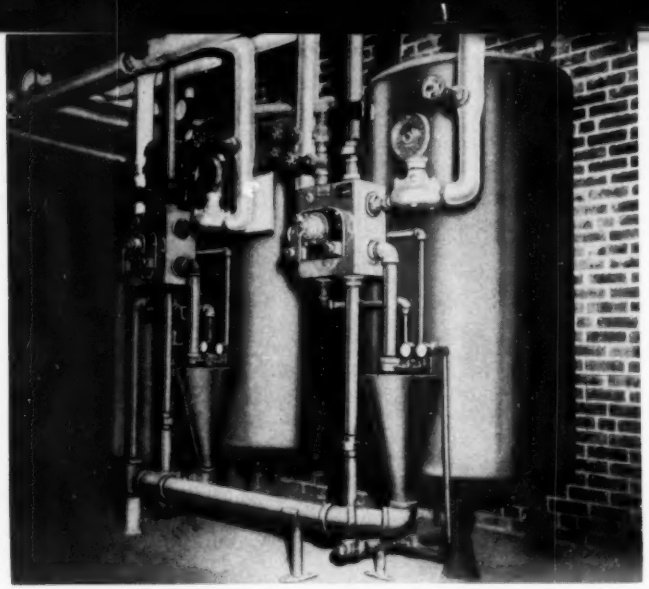


1 Free-base anion-exchange resins regenerated with salt and used in the chloride form take out bicarbonates, sulfates, sulfites, and they do it at low cost

Anion-Exchange Resins: One-Step Way

► GETTING a single high-capacity ion exchanger to reduce raw-water alkalinity as well as soften it, and do the job without using acid, is a definite step toward low-cost water treatment. That step has been made with good results.

Advantages Are Many. First off, it removes the danger of any acid getting into the boiler and does away with potentially hazardous acid-handling chores for plant personnel. Next, it saves on initial equipment costs since there's no need for acid-resistant or degasification equipment. Sometimes existing softening equipment can be converted to perform both dealkalizing and softening.

For operating economies, reducing alkalinity by anion exchange offers still further advantages. It eliminates power costs of pumping since line pressure need not be broken. Only regenerant needed is low-cost salt.

How does this compare with established methods of correcting alkalinity in feedwater supplies? Briefly there are four traditional approaches: (1) Pass a part of the raw water through a sulfonic or carboxylic-type cation exchanger in hydrogen form, then blend the effluent with soft or raw water. Or neutralize the effluent with an alkali like sodium hydroxide to get desired degree of residual alkalinity. (2) Treat raw water with a strongly acid cation-exchange resin regenerated with a mixture of salt and acid, regulating the ratio of salt and acid to produce controlled alkalinity. (3) Use lime in a cold or hot precipitation treatment to reduce bicarbonate alkalinity and raw-water hardness. (4) Introduce an acid directly to the water supply.

Advent of the strongly basic anion-exchange resins opened new possibilities. In the free-base form these resins behave as solid caustic with only the hydroxyl ions in solution. They will absorb negatively charged ions from acid, neutral salt and even mildly alkaline solutions.

Moreover, when you regenerate these resins with salt and use them in the chloride form the chloride ions can be exchanged for the bicarbonates, sulfates, fluorides or sulfides of a water supply. The exchange, though, is not ideal because the chlorides have a greater affinity for the resins and, to that extent, influence equilibrium conditions for adsorption of the bicarbonates. Yet there are two very strong advantages: (1) Exchange is sufficiently complete. (2) Salt as a neutral regenerant is inexpensive enough to make the process economically attractive.

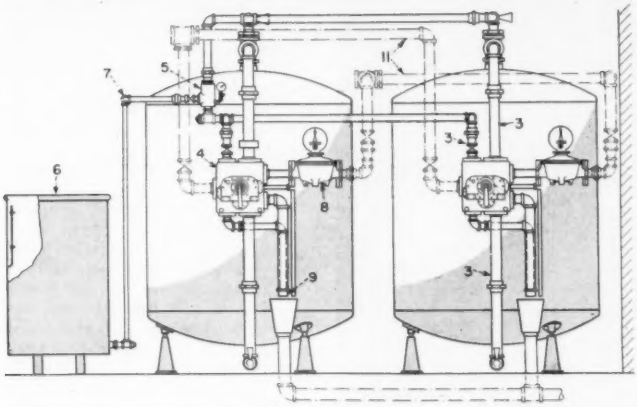
Dealkalization Procedure. For typical dealkalizing operations, Table I shows the approximate pressure drops you can expect for each foot of exchange-resin bed depth in normal 1-6 gal per sq ft per min downflow operation at 70 F.

As these beds perform their service they require periodic backwashing for about 10 min at a time, at a flow rate high enough to cause 50-75% expansion in bed volume. Table II shows typical bed expansion at 70 F under various backwash rates.

In removing bicarbonates, the time raw water remains in contact with the exchange resin is highly critical. So resin-bed depth, which is of considerable importance, should be at least 30 in. You get maximum exchange capacity with the resin of Tables I and II with negligible alkalinity leakage when you use a regeneration level of 4 lb NaCl per cu ft introduced in a 10% solution at a flow rate of 0.5 gal per cu ft per min.

A shift to 3 lb NaCl per cu ft gives about 90% of maximum exchange capacity and an average alkalinity leakage of 4%. Rinsing the bed free of excess chlorides requires 25 gal water per cu ft resin.

Fig. 3 expresses the alkalinity exchange capacity as a function of the ratio of alkalinity to total anions of a water supply in ppm as $CaCO_3$. A service flow rate of two gal per cu ft per min produced the exchange data shown here. Total anions in this ratio include bicarbonates, sulfates, chlorides. To get



Dealkalizer Piping Layout

3—Exchange-tank piping
4—Mixer for diluting brine
5—Brine eductor
6—Regenerative brine - storage tank
7—Brine inlet
8—Water meter
9—Drains for brine and backwash orifice
11—Softened-water outlet

2 One operation removal of calcium and magnesium, bicarbonates and sulfates, involves a three-to-one-ratio combination, preferably not mixed at all, of anion resin to cation with the anion one in this report fixing the combined capacity

To Softening and Reduced Alkalinity

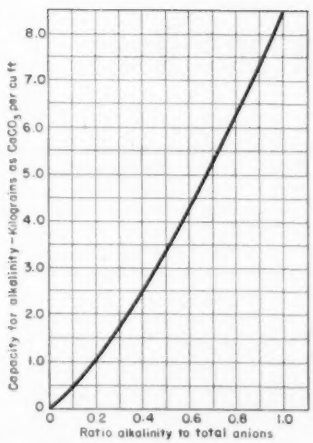
I: Head-Loss Characteristics Typical Exchange Resin*—70 F

Flow rate gal/sq ft/min	Pressure drop Lb/sq in. ft of bed	Ft of H_2O of bed
1	0.11	0.26
2	0.23	0.52
3	0.35	0.80
4	0.46	1.60
5	0.62	1.42
6	0.78	1.80

II: Backwash Characteristics Typical Exchange Resin*—70 F

Flow rate gal/sq ft/min	Bed expansion %
1	17
2	39
3	61
4	83
5	106

*Amberlite IRA-410



3 Alkalinity exchange capacity of the tested resin shows in above curve

total anion-exchange capacity of the resin under test—Amberlite IRA-410—divide alkalinity exchange capacity by ratio of alkalinity to total anions.

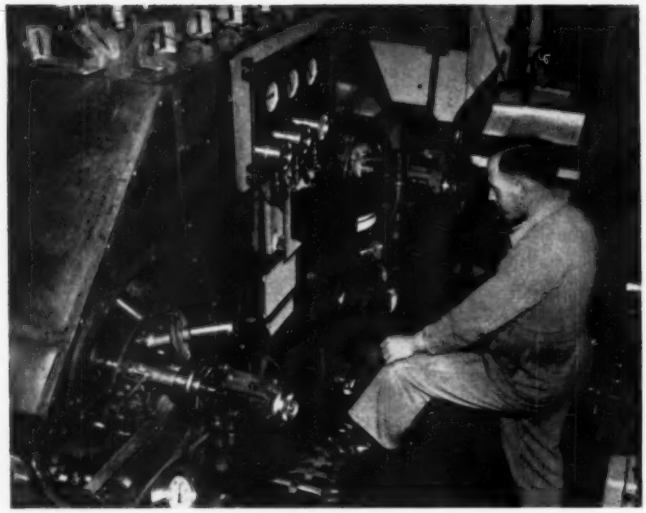
Tests indicate that bicarbonate ion concentrations as high as 500 ppm as $CaCO_3$ (maximum used in our work) have little effect on resin exchange capacity. Chlorides and sulfates appear to have equivalent effects on the capacity.

Simultaneous Softening. Our experiments show it's possible to dealkalize and soften water in a single column. The way we did it was combine the anion-exchange resin, Amberlite IRA-410, in its chloride form with a cation-exchange resin, IR-120, in sodium form, preferably unmixed. With these two products, maintaining separate layers presents no problems because IRA-410 is so much lower in density than IR-120 that it is brought to the top during backwashing and stays there throughout following operations.

Combination of these two resins in their chloride and sodium forms will exchange chloride ions for bicarbonates and sulfates and remove calcium and magnesium in one operation. Both resins use brine as the regenerant. Minimum bed depths are 30 in. of IRA-410 and 10 in. of IR-120. Head-loss values applying to each resin in lb per sq in. and backwash bed expansions in inches may be considered as additive.

Depending on the carbonate or sulfate concentration, or both, of the incoming water, calcium sulfate or calcium carbonate, or both, can precipitate in the IR-120 portion of the bed, assuming the regenerant salt passes through the unit from top to bottom. Because of this, another manifold and lateral system may have to go in at the point of resin layer interface. Then, when regeneration takes place, first por-

(*Continued on page 220*)



NEW LOOK IN SHIPS' ENGINE ROOMS makes bow in first gas-turbine-powered vessel, Anglo-Saxon tanker, *Auris*. Control board is between twin combustion chambers

British Test Gas Turbines For Land, Sea and Rails

► To SPELL OUT more clearly the role of gas turbines, British builders are service-testing units in a variety of applications. Prime interest attaches to trials of Anglo-Saxon Petroleum Co's tanker, *Auris*, first commercial vessel to be powered by a gas turbine.

Built for testing engineering developments in all phases of ship design, the *Auris* was originally powered with four 1105-hp diesels. As planned, one of these has been replaced by a British Thomson-Houston gas-turbine plant. In this open-cycle design, the h-p turbine drives an axial compressor, the l-p turbine an 860-kw ac generator. Twin combustion chambers form a unit with the tubular regenerator. Design maximum temperature is 1200 F; test efficiency is 21.4%.

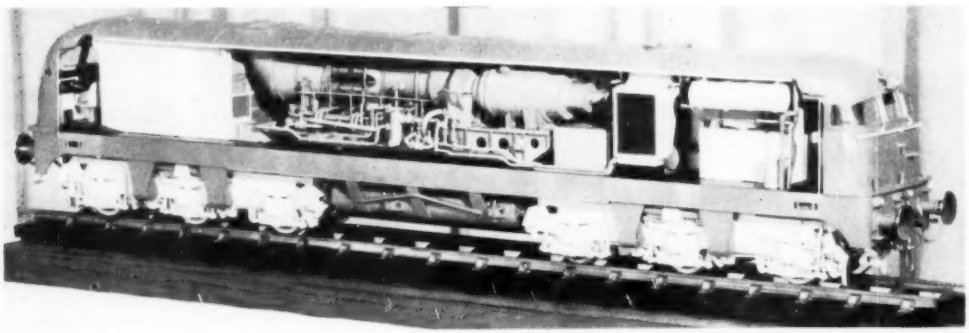
The *Auris*' gas turbine had piled up some 2000 operating hours by the beginning of this year, including a round trip across the Atlantic during which the turbine plant operated without forced shutdown. The tanker is now on a second round trip of the Atlantic, during which the gas-turbine plant will be used exclusively.

First sea trip was made on diesel fuel. Since then, boiler fuel has been used. This is preheated to 180 F and passed through a DeLaval centrifuge and clarifier in series. Both compressor and heat exchanger were washed after the first Atlantic round trip. This is done through apertures in the casing. Routine inspections have been made but the casings have not been lifted.

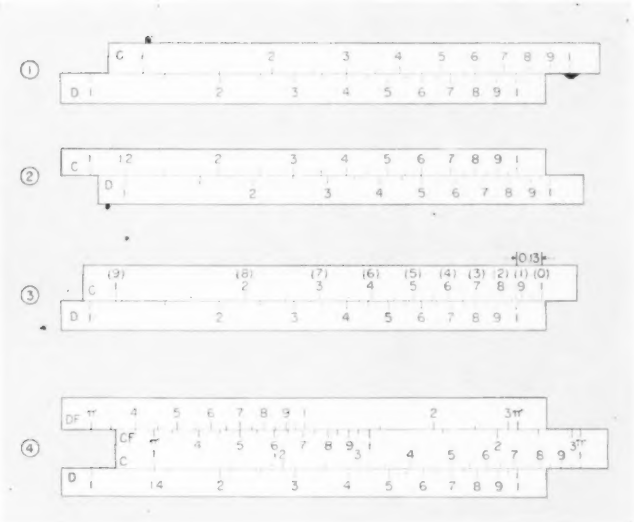
G-T Locomotive. Great Western Railway recently took delivery of the first British-built gas-turbine locomotive, a 3000-hp Metropolitan-Vickers Electrical Co design. (GWR already has a Brown Boveri g-t locomotive.)

Burning gas oil at temperatures up to 1292 F, the simple open-cycle gas turbine develops a full-load efficiency of 19%. The 15-stage axial compressor provides a 5.25:1 pressure ratio. Six combustors supply the 5-stage turbine. Some compressor air is used for cooling and thrust-balancing.

Industrial Unit. The Ruston and Hornsby 750-kw industrial gas-turbine generator set has completed extensive shop tests and with some design modifications is ready for quantity production. Units are available with or without a plate-type regenerator; respective efficiencies are estimated as 24 and 17%. A Ruston unit will be used in government - sponsored peat - burning tests.



FIRST BRITISH G-T LOCO appears here in cutaway. Enclosure at left, houses train-heating boiler and compressor. Power plant in center comprises turbine, combustors, compressor and dc generators. Oil coolers and brake apparatus at right



Some Slide-Rule Hints

► MOST OF THESE slide-rule tricks will be found in some instruction books, but many users tend to overlook them. So when they're needed, they aren't remembered. Here are some of the most useful:

1. When you have a long list of numbers all to be divided by the same number, a, it isn't necessary to reset the rule for each division. Simply perform the division $1/a$ by setting a on the C scale opposite the nearest index on the D scale, then read the answers on the D scale opposite the number being divided on the C scale.

Example: 1.5, 3, 4.5 and 6 are to be divided by 0.75. Find the answers. Set 7.5 on the C scale opposite the right index on the D scale. Fig. 1. (This gives a common multiplier of 1.333 on the D scale, but this need not be noted.) Opposite 1.5 on C find 2 on D, opposite 3 on C find 4 on D, opposite 4.5 on C find 6 on D, opposite 3 on C find 4 on D, opposite 4.5 on C find 6 on D, opposite 6 on C find 8 on D.

Example: 9, 6, 3 are to be divided by 1.2. Set 1.2 on the C scale opposite the left index on D, Fig. 2. On D opposite given numbers on C find answers, 7.5, 5, 2.5.

2. In some problems several numbers must each be divided by a quantity $(1-a)$. Often the subtraction can be done mentally, but as a check the quantity a can be tallied off directly on the rule helping to avoid error in mental calculation. Look at the C scale. Fig. 3, and assume that it is numbered from 0 to 9, right to left, as shown by the numbers in parentheses. Find the number a on the renumbered C scale, and set it up against the right index of D. Then work on the numbers to be divided as in the first method.

Example: Divide 3, 4, 5, 6 and 7 by (1-0.13). On the C scale, Fig. 3, mentally renumber 9 to represent 0.1. Find 0.13 which corresponds to 8.7. Then opposite the given numbers find the answers, 3.45, 4.6, 5.75, 6.9, 8.05. (Note that the scale numbers and corresponding numbers in parentheses on the C scale each add up to 10.)

3. Those folded scales CF and DF starting and ending with π are of far more use than just for formulas involving π. Fig. 4. When properly used they effectively double the length of your rule. When you find the setting of your rule runs off the C or D scales for a given calculation, don't move the slide, but simply switch to the CF or DF scales for your answer.

Example: Multiply 8 by 1.4. Setting left C index to 1.4 on the D scale, for minimum slide movement, you'll find that 8 on the C scale is way off the calculating area on D. So now look for 8 on the CF scale, and opposite it on the DF scale find the answer 11.2.

In effect the folded scales are simply a convenient extension in both directions of the straight scales.

P. J. CROGAN, *Notre Dame, Ind.*

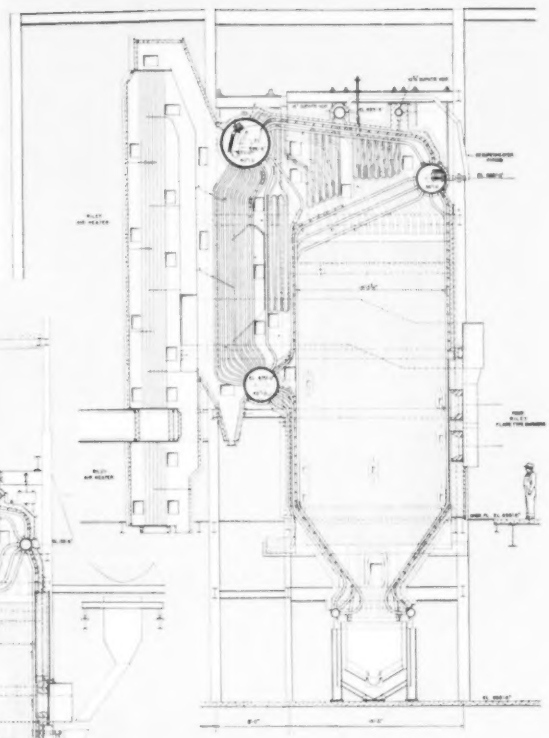
© POWER

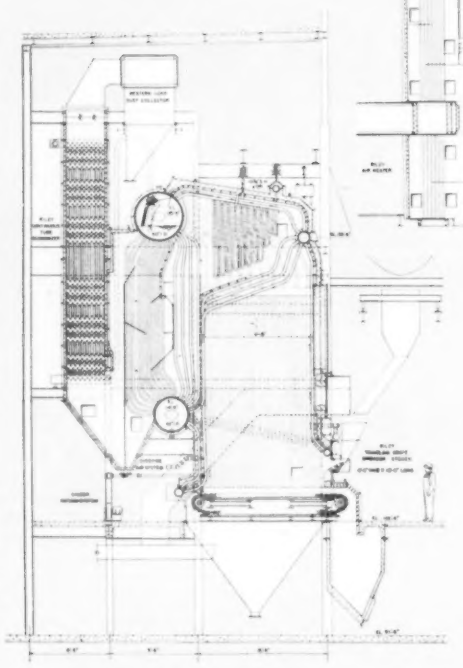
RILEY Boiler Units preferred

INTERSTATE POWER CO.
LANSING, IOWA
Sargent & Lundy, *Engineers*

2—120,000 lbs. /hr. Riley Units
Steam Pressure—975 lbs.
Steam Temperature—910°F.
Pulverized Coal Fired

Interstate Power Company also has Riley Units in their plants at Clinton and Dubuque, Iowa and Shelbourne Falls, Minn.





IOWA-ILLINOIS GAS & ELECTRIC CO.
IOWA CITY, IOWA

2—60,000 lbs. /hr. Riley Units
Steam Pressure—500 lbs.
Steam Temperature—740°F.

Fired by Riley Traveling Grate Spreader Stokers

RILEY

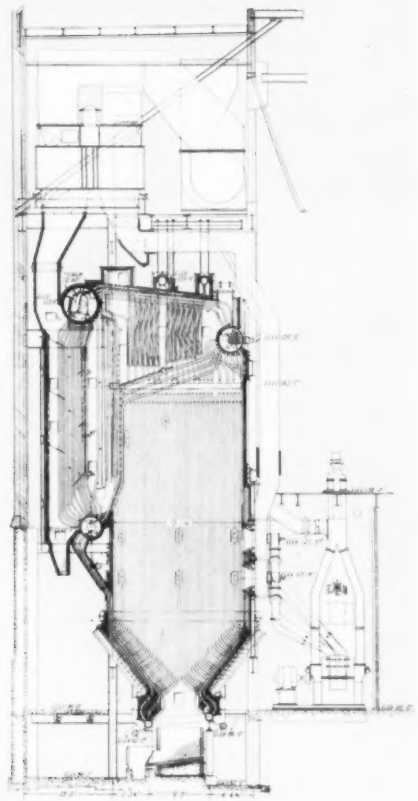
STOKER CORPORATION, WORCESTER, MASS.

Boston · New York · Philadelphia · Washington · Buffalo · Pittsburgh · Cleveland · Detroit · Chicago
Cincinnati · Charlotte · Atlanta · New Orleans · St. Louis · Kansas City · St. Paul · Tulsa · Houston
Denver · Salt Lake City · Los Angeles · Portland · Seattle

BOILERS • PULVERIZERS • BURNERS • STOKERS • SUPERHEATERS • FLUE GAS SCRUBBERS

out where the corn grows tall

By far the big majority of recent large boiler installations in the state of Iowa have been Riley Steam Generating Units



IOWA-ILLINOIS GAS & ELECTRIC CO., DAVENPORT, IOWA

3—250,000 lbs./hr. Riley Units
Steam Pressure—1000 lbs.
Steam Temperature—850°F.
Fired by Pulverized Coal

Iowa-Illinois Gas & Electric also has Riley Units in their Moline, Ill. and Iowa City, Iowa plants.

All of these Iowa companies have Selected Riley Units in recent years

IOWA ELECTRIC LIGHT & POWER CO.
Marshalltown, Iowa
325,000 lbs./hr. 975 lbs. 910°F.

IOWA ELECTRIC LIGHT & POWER CO.
Boone, Iowa
300,000 lbs./hr. 775 lbs. 835°F.

IOWA-ILLINOIS GAS & ELECTRIC CO.
Davenport, Iowa
3—250,000 lbs./hr. 1000 lbs. 850°F.

IOWA-ILLINOIS GAS & ELECTRIC CO.
Moline, Ill.
2—200,000 lbs./hr. 925 lbs. 825°F.

IOWA-ILLINOIS GAS & ELECTRIC CO.
Iowa City, Iowa
60,000 lbs./hr. 500 lbs. 740°F.

INTERSTATE POWER CO.
Lansing, Iowa
2—120,000 lbs./hr. 975 lbs. 910°F.

INTERSTATE POWER CO.
Dubuque, Iowa
200,000 lbs./hr. 725 lbs. 910°F.

INTERSTATE POWER CO.
Shelbourne Falls, Minn.
2—120,000 lbs./hr. 700 lbs. 910°F.

INTERSTATE POWER CO.
Clinton, Iowa
45,000 lbs./hr. 450 lbs. 465°F.

IOWA PUBLIC SERVICE CO.
Carroll, Iowa
2—60,000 lbs./hr. 475 lbs. 750°F.

CORN BELT POWER CO-OP.
Humboldt, Iowa
125,000 lbs./hr. 700 lbs. 825°F.

CORN BELT POWER CO-OP.
Humboldt, Iowa
165,000 lbs./hr. 1000 lbs. 915°F.

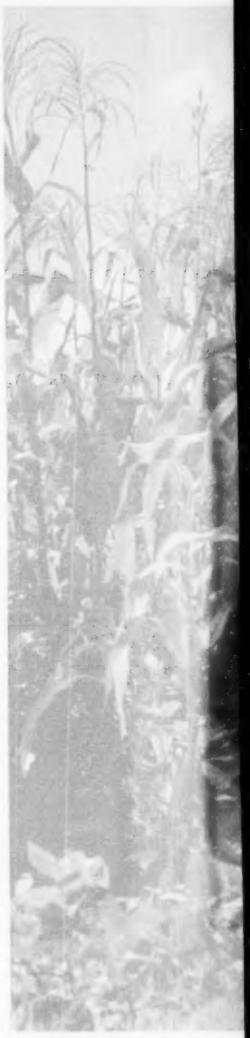
RATH PACKING CO.
Waterloo, Iowa
125,000 lbs./hr. 450 lbs. 675°F.

IOWA STATE COLLEGE
Ames, Iowa
100,000 lbs./hr. 275 lbs. 506°F.

IOWA STATE COLLEGE
Ames, Iowa
80,000 lbs./hr. 260 lbs. 423°F.

CITY OF AMES, IOWA
95,000 lbs./hr. 700 lbs. 830°F.

The majority of the above installations are pulverized coal fired. Some are fired by Riley Traveling Grate Spreader Stokers and others by Riley Traveling Grate Stokers. We believe no other boiler company can point to such a large number of boiler sales in Iowa during the past few years.

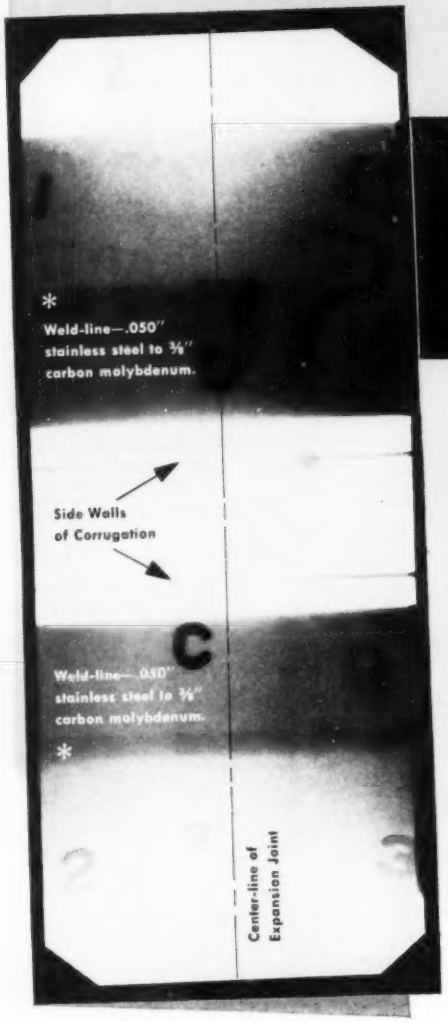


A survey of your Power Plant by a consulting engineer will possibly show ways of making surprisingly large savings in your power costs

COMPLETE STEAM GENERATING UNITS

. . . it will pay you to visit modern Riley Installations before purchasing Boiler or Fuel Burning Equipment

ECONOMIZERS • WATER-COOLED FURNACES • STEEL-CLAD INSULATED SETTINGS • AIR HEATERS



HERE'S WHY...

you can't buy a better Expansion Joint than a ZALLEA!

When the U. S. Navy specified use of 180 Zallea Welding Type 347 Stainless Steel Expansion Joints for a steam pipe installation on a new type vessel, job requirements included X-ray examination of all joint-to-pipe welds (.050" stainless steel to 3/8" carbon molybdenum seamless pipe).

This was a rigid test, since the revealing eye of the X-ray would immediately ferret out the slightest defect or trace of slag inclusion that might cause failures at welds after the pipe line went into service.

But when X-rayed, *not one* of the 360 Zallea welds disclosed any flaws or slag inclusion! In reporting test results, the independent industrial laboratory making the examination wrote: "*We have never seen more perfect welds under X-ray.*"

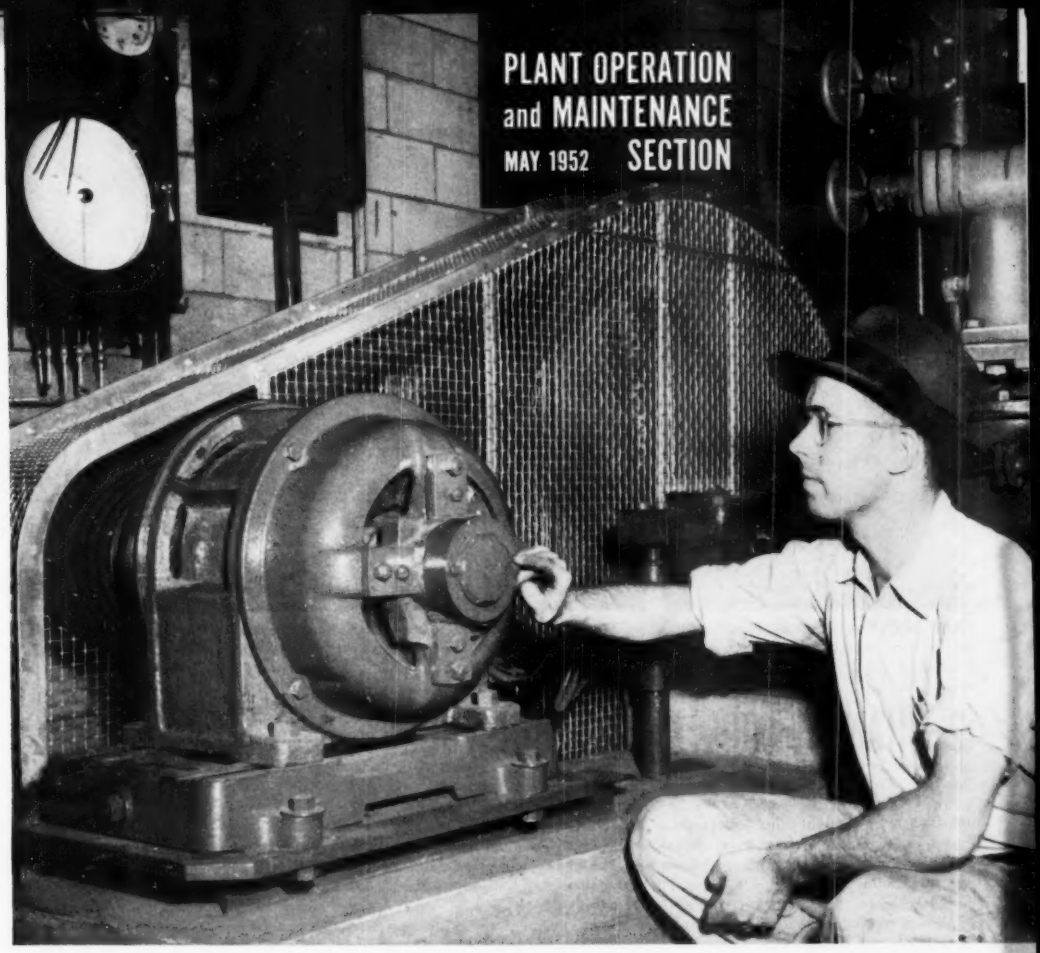
The exclusive Zallea *controlled* welding technique used on this job is the same technique applied in the manufacture of every Zallea Expansion Joint that leaves our plant. It's your assurance that when you buy Zallea Expansion Joints, you buy the best. They're better built . . . last *far* longer. So next time you consider expansion joints, specify Zallea . . . you'll find it pays!

Zallea Expansion Joints are available in diameters from 3 inches to 30 feet for temperatures from sub-zero to 1600° F . . . for pressures from vacuum to 300 psi in standard designs and up to 2000 psi in special designs. Zallea Brothers, 814 Locust Street, Wilmington 99, Delaware.

Write today for Catalog 47 and Bulletin 351 which illustrate all Zallea Expansion Joints.

Zallea
EXPANSION JOINTS

WORLD'S LARGEST MANUFACTURERS OF EXPANSION JOINTS



REBUILT motor bearing is inspected by R C Hogan, power supt of large provision firm. Motors give years of service now

5 TESTED MAINTENANCE HINTS

1—MOTOR BEARINGS SHOT?

. . . Replace with tapered roller type

► In our big packing-house power plant, we have a number of large electric motors. These motors, in steady service for years, finally needed a major overhaul.

Motor shown in photo is 25 hp, hooked up to a new ammonia compressor. Because old-type sleeve bearings were badly worn, we removed the sleeves. Also rotor shaft, which was turned at bearing ends. New tapered roller bearings were installed inside bearing housings. These housings were welded to four pieces of strap iron to fit over ribs on motor ends. With rollers installed, this assembly was slipped over motor's shaft and bolted to housing with eight ½-in. capscrews.

This bearing repair has worked so well that we have since replaced the old sleeve bearings on two of our 40-hp motors for the other compressors, in the same way.

R C Hogan

Canton, Ohio

More on next page

TUBE TESTER is shown by Fred Schilling

TO USE, place inside tube about six inches from end. Thin tubes give when pried

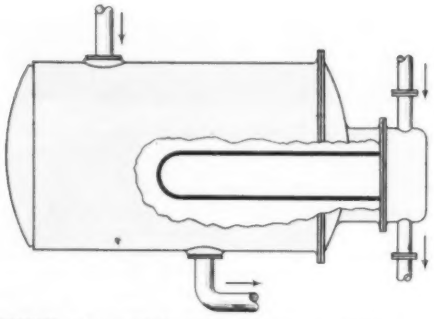
2—HANDY TOOL FINDS THIN TUBES... saves costly unexpected outage

► TUBES IN straight-tube boilers thin most about six inches from tube sheets. Problem is to find thin tubes before putting boiler on line.

After more than half a century of boiler repairing, I've made a simple, practical tool to check for dangerous thinness. Tool is made of ½-in.-round stock. One end has 90-deg bend. This short end is slightly longer than inside tube diameter and rounded to small radius at the tip.

Long end has slight kink near bend. Place tool in tube at suspected thin spot, pry downward so rounded end bends tube if it's thin. A little practice gives right feel. Test tubes each 90 deg about 6 in. at both ends. You may be surprised at number of thin tubes in your boilers after checking like this.

FRED SCHILLING *Buffalo, N. Y.*



PRESSURE didn't explode tank, but vacuum knocked it out

3—COLLAPSED HEATER...

Temperature regulator could have saved it

► DOMESTIC HOT-WATER storage tanks often let go with a bang—may even collapse. To save costly repair, know causes.

Tank shown here collapsed. It's 98% copper, 2% nickel for saline water. Vessel is 6 ft 9 in. long, 3 ft 6 in. dia, 3/16 in. thick. Heating element has 1-in. copper U-tubes, 3 ft 3 in. long. Steam is 40-60 psi. Vessel is well constructed to withstand pressure.

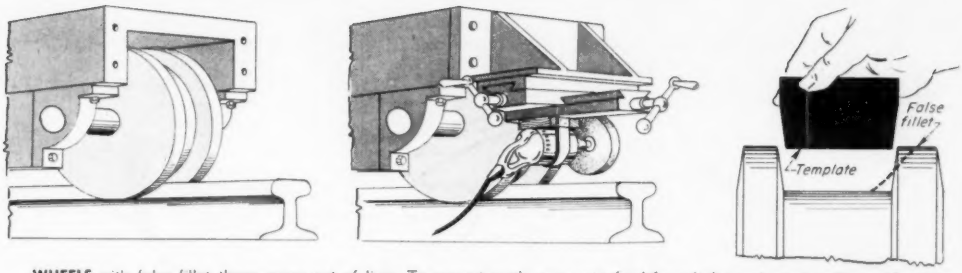
Tank's water supply was in two 5000-gal tanks, 35 ft overhead. A 3-in. pipe connected them to heater but they had no vent or atmospheric valve. Heater served 18 years. Thermostatic valve to keep water at 180 F failed year before heater collapsed. So steam was hand regulated.

Before collapse, water got up to 250 F; steam supply to heating coil was shut off at once. Temperature was high enough to generate steam in water chamber of heater. Water condensed from overhead tank's cold-water flow to heater. As steam pressure dropped, vacuum was created. That collapsed shell and heater heads—weakened from pressure.

We replaced heater—this time installed a vent pipe.

Heaters designed to withstand bursting pressure may not be strong enough to prevent collapse. Install automatic control valves, vent or atmospheric valve if needed.

H A HERRON *Montreal, Canada*



WHEELS with false fillet throw crane out of line. To correct easily, use cross feed from lathe and grind to fit template

4—CRANE MISALIGNMENT . . . can be corrected without removing wheels

► CRANES OFTEN TRAVEL "out of square" and bind in the runway. Causes are oil on tracks, excessive acceleration, quick stops, jerking, pulling freight cars, etc.

Crane is then usually straightened in the tracks by bringing it up against the end bumpers, and bumping crane gently against them. If the crane still travels out of square and binds, first check the track alignment. Use a steel tape and measure the span at 12-in. intervals. Variation from standard should not exceed $\frac{1}{8}$ in. either way. If alignment is OK, check the wheels.

If straight-tread wheels are used, as in sketch, a false fillet sometimes forms. Fillet is usually on inside of inner flange of one wheel, and on inside of outer flange of wheel on opposite side of crane. This false fillet is formed by metal cut or rubbed from flange itself (also from rail), and is deposited as fillet and packed in. It becomes hard as the wheel itself and can be removed only by grinding.

To avoid taking wheel off and down for grinding, we use a compound rest from an old lathe. Attach a straight high-frequency grinder, speed 5400 rpm, 6-in. wheel capacity. Grinding rig has bracket to hold grinder in tool rest. Compound rest is bolted to shelf bracket, as shown, with rig clamped to truck end next to wheel to be ground.

Raise crane end trucks with a hydraulic jack. Block them up, and start grinding. If a driving wheel is ground, both drivers must be raised off the tracks. Then turn on power and rotate wheels slowly while grinding. Make a tread template of sheet metal as a guide.

The two driver wheels must be same diameter when grinding is finished. This can be measured by a steel tape around the wheel at tread's center. Circumference should not differ by more than 1/16 in. Rotate idler wheels by hand while grinding. Use a bonded 6-in. grit stone $1\frac{1}{2}$ or 2 in. wide, with a proper fillet edge. Maintain right shape with an emery wheel dresser.

With a little experience in setup, two men can grind a set of four wheels in about 12 hours, without taking off wheels. Crane operating on tracks badly out of alignment should have taper tread wheels for the drivers, and wide, straight tread wheels for the followers.

Crane misalignment is common and should be checked from time to time.

L M LARSON *Milwaukee, Wis.*

5—JUNKING WOODEN TANK . . . above busy railroad is problem

► I HAD TO SCRAP a 30,000-gal wooden sprinkler-service tank, 18 ft dia and 18 ft high. Tank had been dry for years, so wood siding had shrunk. Many upper iron hoops had slipped down. Should I build an outside scaffold? We cut 2-ft-square opening in tank's bottom. Then attached a trough to slide down a ton of sludge. Opening was also the entrance instead of going over top.

We built a scaffold inside halfway up. Then removed roof and lowered pieces through bottom opening.

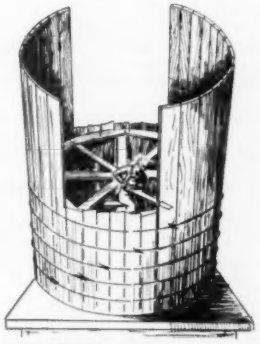
Siding was 3x6 pine. We cut each piece at halfway mark. A sharp north wind blew about time we started. To unbalance wind pressure we first cut one piece off north side, then one off south side until job was finished. Remember, trains were running 60 ft under us.

After removing loose hoops, we removed one piece of siding on railroad side. We cut hoops through this opening, dropped them to roof. If lower hoops were removed, tank would collapse.

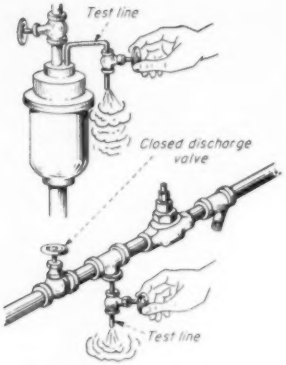
We lowered scaffold and nailed every piece of siding to scaffold. Siding could not slip down as they were tongue-and-grooved at bottom, with a nail in each. We cut rest of hoops, then removed each siding piece.

I never tackled a job like that before, and was sure glad when finished.

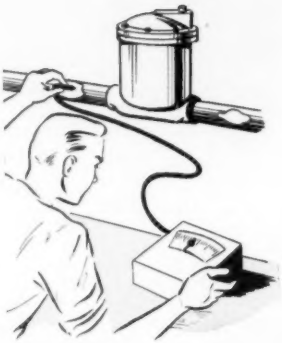
GEORGE GRIFFEL *Bronx, N. Y.*



TEARING DOWN tank can be problem

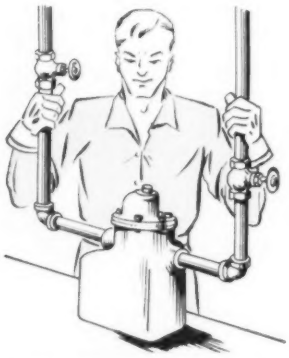


1 **TEST VALVE,** trap discharge section or line, allows tightness check

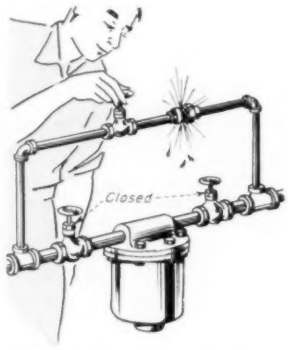


2 **PYROMETER** checks inlet, discharge temperature. File two spots

3 **STEEL ROD** held against trap body helps you to hear discharge action



4 **GLOVE TEST** checks inlet, outlet temperature; it is easy to make



5 **LEAKY BYPASS** valve wastes plenty steam. Check tightness regularly

6 **CLEAN TRAP** parts in suitable fluid for good system operation

Know-How Keeps Steam Traps Healthy

Your surest bet for long trap life and better plant efficiency is right maintenance. Here are solid tips for most of the traps you will use, also a trouble-shooting chart for easy checks

By **TYLER HICKS**
Associate Editor

► IF YOU WANT TO LIVE happily with your steam traps you have to treat them right. They're just like any other piece of mechanical equipment—they need regular inspection and maintenance.

Trap Tests. Make these regularly. Check large high-pressure traps daily. Do the same for units handling dirty or corrosive condensate. Look over medium-pressure traps once a week. Low-pressure systems need a monthly check.

Best way to test a trap is with test-valve hookup, Fig. 1. Some traps have a tapping for test connection. On others you have to fit a tee in return line. Be sure there's a tight valve beyond test connection to isolate trap from return line.

If steam comes from test line, look for trouble. Some traps give off "lazy" flash when air is mixed with steam, or condensate load is light. Others discharge almost continuously when there's too much air in system. Traps that have lost their prime blow steam at high velocity. Close inlet valve a few minutes, then open slowly. If trap catches prime, its mechanism is probably OK.

Pyrometer Method. File clean spots on inlet and discharge lines. Take temperature readings of incoming steam,

TROUBLE-SHOOTING CHART FOR STEAM TRAPS

TROUBLE	POSSIBLE CAUSE AND CURE
TRAP DOESN'T DISCHARGE	1 Steam pressure too high, pressure-regulating out of order, boiler pressure gage reads low, steam pressure raised without altering or adjusting trap. On the last item consult trap maker. He can supply parts for higher pressure or tell you how to adjust trap 2 Plugged strainer, valve or fitting ahead of trap; clean 3 Internal parts of trap plugged with dirt or scale; take trap apart and clean. Fit strainer ahead of trap 4 Bypass open or leaking; close or repair 5 Internal parts damaged or broken; dismantle trap, repair
TRAP WON'T SHUT OFF	1 Trap too small for load; figure condensate quantity to be handled and put in correct-size trap 2 Defective mechanism holds trap open; repair 3 Larger condensate load from (a) boiler foaming or priming, leaky steam coils, kettles or other units, or (b) greater process load; find cause of increased condensate flow and cure, or install larger trap *Note:* Traps made to discharge continuously won't show these symptoms. Instead, the condensate line to trap overloads; water backs up
TRAP BLOWS STEAM	1 Open or leaky bypass valve; close or repair 2 Trap has lost prime; check for sudden or frequent drops in steam pressure 3 Dirt or scale in trap; take apart and clean 4 Inverted bucket trap too large, blows out seal; use smaller orifice or replace with smaller trap
TRAP CAPACITY SUDDENLY FALLS	1 Inlet pressure too low; raise to trap rating, fit larger trap, change pressure parts or setting 2 Backpressure too high; look for plugged return line, traps blowing steam into return, open bypass or plugged vent in return line 3 Backpressure too low; raise
CONDENSATE WON'T DRAIN FROM SYSTEM	1 System is air-bound; fit suitable vent or trap with larger air capacity to get rid of the air 2 Steam pressure low; raise to the right value 3 Condensate short-circuits; use a trap for each unit
NOT ENOUGH STEAM HEAT	1 Defective thermostatic elements in radiator traps; remove, test and replace damaged elements 2 Boiler priming; reduce boiler-water level. If boiler foams, check fires and feed with fresh water while blowing down boiler at quarter-minute intervals 3 Scored or out-of-round valve seat in trap; grind seat or replace old trap body with new one 4 Vacuum pump runs continuously; look for a cracked radiator, split-return main, cracked pipe fitting or a loose union connection. Or pump shaft's packing may leak 5 Too much water hammer in system; check drip-trap size. Undersized drip traps can't handle all condensate formed during warm-up so hammering results. Fit larger trap if drip lines are clean and scale-free. Size for warm-up load, not for load with mains hot 6 System run down; older heating plants are sometimes troublesome because a large number of trap elements are defective. Easiest cure is replacement of all thermostatic elements in the radiators. This is low-cost, sure
TRAPS FREEZE IN WINTER	1 Discharge line has long horizontal run where water collects; make discharge line as short as possible and pitch away from trap 2 Trap and piping not insulated; fit insulation to outdoor traps and piping connected to them
BACK FLOW IN RETURN LINE	1 Trap below return main doesn't have right fittings; use check valve and a water seal, or both, depending on what the trap maker recommends 2 High-pressure traps discharge into a low-pressure return; flashing may cause high backpressure. Change piping to prevent return pressure from exceeding trap rating 3 No cooling leg ahead of a thermostatic trap that drips a main; condensate may be too hot to allow trap to open right. Use a 4- to 6-ft cooling leg ahead of thermostatic traps on this service. Fit strainer in cooling leg to keep solids out of trap

outgoing condensate, Fig. 2. If inlet temperature is about same as that of steam, and outlet is at or near that of steam in common return, trap is good.

When pyrometer shows rise and fall in discharge temperature, trap is working intermittently. If outlet temperature is nearly the same as inlet steam temperature in bucket traps, steam is blowing through. Impulse traps often have higher outlet temperature than other types, discharge continuously on many loads.

Use Your Ears. Hold one end of steel rod against trap, Fig. 3, and listen for discharge. If innards rattle much, trap may have lost prime. When you make this test don't be fooled by other sounds "telegraphed" along pipe.

Canvas Gloves. Put on a pair of these and grab inlet line with one hand, discharge with other, Fig. 4. You should be able to feel a distinct temperature difference with most traps. Without a difference, the trap has lost its prime.

Bypasses. Traps are easier to live with if fitted with a bypass. But if you neglect bypass valve, it may leak more steam than you'd ever think. So it's smart to disconnect bypass line once a year and test bypass valve with full working steam pressure, Fig. 5. Replace disk or seat at once if valve leaks.

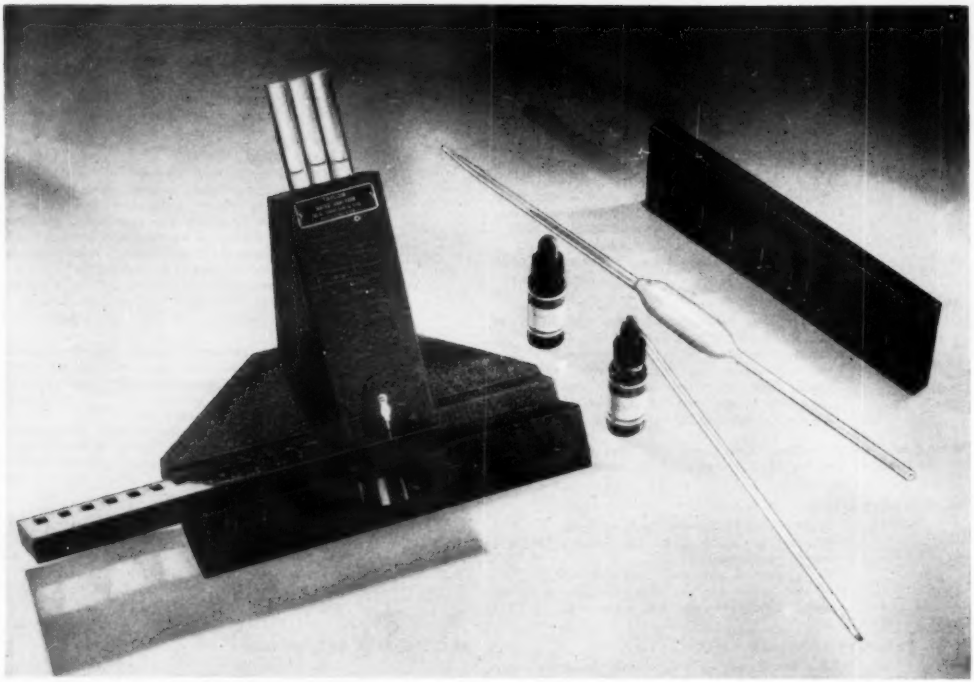
Strainers. These are low-cost and save much misery. But don't forget that a strainer doing its job gets dirty. A dirty strainer ahead of a trap is almost worse than none at all. So clean your strainers regularly. Easiest way is to install a permanent blowoff line. If you have to remove the screen from a strainer in a vertical line, be careful not to allow dirt to fall into pipe.

Freezing. Sometimes unprotected traps freeze in extremely cold weather. With traps that are not non-freeze, keep discharge line short without any horizontal runs. Some trap makers have automatic drain valves that allow condensate below a certain temperature to leave trap and inlet line after steam is shut off.

Remember, some traps don't need freeze protection. But play safe and insulate outdoor traps. Heat savings make it worthwhile.

Dirt in Trap. If much sediment and scale collect in a trap, you'll probably have to take the unit apart. Wash parts in kerosene, rust-penetrating oil, or other cleaning fluid. Traps in lines serving reciprocating engines or pumps may have a coating of oily paste if too much cylinder oil is used. Always check this when you have trap apart.

Trouble-shooting chart, above, gives some hints on trap care. Remember, it is general, and some traps may react a little differently, depending on their design. If you ever have any doubts call in trap manufacturer.



QUICK AND EASY WAY of running periodic checks on the pH of industrial waters is no problem. Simple, compact, accurate colorimetric comparators, like above, do the job well; need little skill. Proper pH control reduces corrosion and scaling

No good plant operating man would turn his back on any short cuts to easier maintenance, smoother operation. Here's some know-how on an often overlooked plant tool that you can add to your kit

By H L BOYER JR, *Water-Conditioning Section, Allis Chalmers Mfg Co*

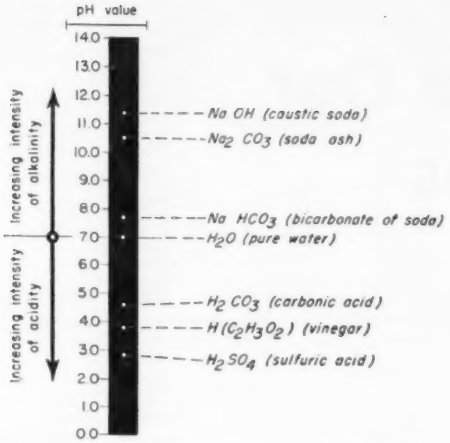
How to Make pH a Working Tool

► TOO MANY PRACTICAL power-plant men deliberately shy away from one of the most helpful water-treatment tools —pH values. If you try to pin them down on why, they'll say it's a chemist's term—belongs in the laboratory.

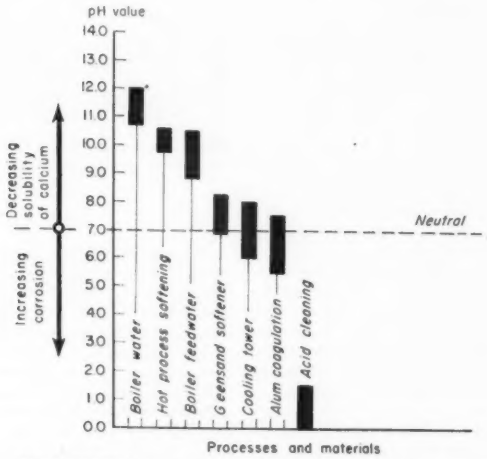
Yet these same men know that voltage and current readings, pressure and temperature are part and parcel of good operation. Over the years they've found out first-hand that the information these readings give can point out possible trouble points, explain breakdowns. Apparently they don't realize the little factor of pH can do the same job for water.

pH at Work. Maybe they've got to be shown. There are any number of proofs. For instance, the pH value often serves as the control factor for power-plant or industrial-water treatment, see figures on facing page. Generally you'll find corrosion speeds up as pH decreases. And, on the other hand, calcium becomes less soluble as pH increases.

Right off the bat you'll see how this info can be put to work in boiler water. Get pH up (usually 10.5 to 12.0 is best) and corrosion troubles vanish while at the same time unwanted calcium drops out of solution. One reason for controlling pH between 10.5 and 12.0 is you want this calcium to come out as an insoluble sludge so blowdown can take it out of the drum. Too high a pH, and scale becomes hard, sticks to metal parts. Usually recommended water-



START OFF with an absolutely pure water and add 100 ppm of the indicated materials and you affect the pH as shown above



FOR A WATER, best pH depends exactly on how you plan to use it. This chart shows a range of good pH values for various needs

treatment materials, top diagram, bring boiler water within proper pH range. Too much or too little misses the mark.

In plants using hot-process softeners to remove calcium and magnesium, a pH of 9.8 to 10.5 gives best results. Lime and soda usually give this range. Where a hot phosphate softener is put in to give "zero" hardness, best results come at 10.5.

With natural greensand softeners, emphasis is on raw incoming water. Greensand works as a softener only if raw-water pH lies between 6.8 and 8.2. Outside this range the sand no longer holds its softening ability.

How about some other everyday examples? Any time corrosion starts to attack boiler feed lines, pumps, economizers, the control of pH between 8.8 and 10.5 becomes highly important.

You'll find pH at work again in removing oil from water by filtration. Here a pH between 5.5 and 7.5 sets up the most favorable zone for proper coagulation with alum. Final pH adjustment can be had by varying the ratio of alkali to alum.

Actual Difference in pH Values

pH value	Values showing intensity of acidity, alkalinity
0	10,000,000
1	1,000,000
2	100,000
3	10,000
4	1,000
5	100
6	10
7	1
8	10
9	100
10	1,000
11	10,000
12	100,000
13	1,000,000
14	10,000,000

Meaning of pH. But citing examples could go on forever. Let's see what pH really is. Every operating man knows water is seldom neutral. It's usually alkaline, sometimes acid. A chemist can give you an analysis that shows exact amount of acid or alkali present. Often, though, you're not concerned with amounts but with how strong or weak acid or alkaline conditions are. Here's where pH shines.

A pH of 7.0, top diagram, indicates a neutral solution, neither acid nor alkaline. Below 7.0, the solution has a greater *intensity* of acidity. Above 7.0, the *intensity* becomes one of alkalinity. So pH really is a number that registers *intensity* of acidity or alkalinity for any solution, never quantity.

The scale commonly used for pH value and shown in the two diagrams can mislead you. A change of 1.0 in pH really means a difference in intensity (acid or alkaline) ten times that before. Table gives the true relation between different pH values.

Top figure on this page drives home the point that quantity has nothing to do with pH. Each sample on this figure is one carrying 100 ppm of the material shown. Take carbonic acid. A 100-ppm solution has a pH of 4.6. The same strength solution of sulfuric acid registers a pH of 2.8. All the pH shows is that sulfuric is a much stronger acid than carbonic.

Measuring pH is the next step. There are two basic ways: (1) Electrometric. The most precise laboratory measurements use a specially designed pH meter. (2) Colorimetric. For the usual plant this method works all right. You can get required equipment, instructions and all, in compact, easy-to-use form like that in facing page photo.

What Knocks Out Diesel Valves

Wrong lubrication oil

Springs weakened in many ways

Carbon formations

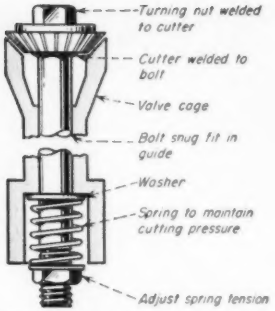
Bent valve stems

Dirty or wrong type filter

Wrong fuel oil

. . . and many other things

By C MORGAN JONES, *New York, N. Y.*



CUTTER for valve seat is used by holding cage in jig. The seat is renewed quickly

GRIND seat with wheel of right angle. Rod placed in stem guide centers wheel

► "I GROUND THAT VALVE all morning and it looked OK," Mac complained. "But when I put the cage back into the cylinder head and started the engine, what happened? It leaked. So I spent an afternoon doing the job a second time. But it still leaks."

I explained to Mac what happens. Usually valve's seat and face are a perfect match when assembled and tested in valve cage on bench. But when cage is tightened into cylinder head, valve seat is forced slightly out of round. The cage also gets distorted from uneven cooling in engine, or from tightening nuts unevenly.

To cure, remove cylinder head with cage in place. Then grind valve true while seat is distorted. Lot of work? It'll give you a tight valve without buying a new cage. Or it'll save machine work—which doesn't always pay.

Sticking Valves. Commonest trouble is valves sticking open. Sticking valves advertise. Engine misses a lot and exhaust temperature is low in affected cylinder. There's also a different noise from push rod, cam follower and rocker arm because of "float" between cams and valve stem.

Sticking valves can cause serious trouble. Not only is firing prevented, but also piston crown may hit valve head and break off. Result may be cracked cylinder head or piston, bent connecting rod or damaged main bearings or crankshaft. Valve bits also score and cut liner, rings and piston.

Why Valves Stick. Valves usually stick because of wrong kind of lube oil. In rare cases, fuel produces a gummy substance that sticks to stem and valve guide. Other reasons are: weak or broken valve springs, bent valve stems, distorted valve guide, or valve stem cap wear.

Use Detergent Oil. If valve sticks regularly, change to a detergent lube oil. Such oils stop formation of sticky deposits, or help reduce it.

If you switch oils, change them after only one-quarter of normal running time. Reason is new detergent oil breaks loose deposits. What isn't carried along to filters usually sticks to lube-oil passages.

Leave second charge of oil in for two-thirds of normal period. By then it removes all deposits that first charge loosened but failed to shift. By third oil charge, valve sticking should be cured.

Filters. Be sure to change filters when necessary. Watch oil-pressure gage, or filters may plug and starve oil supply to engine. Dirt builds up pressure.

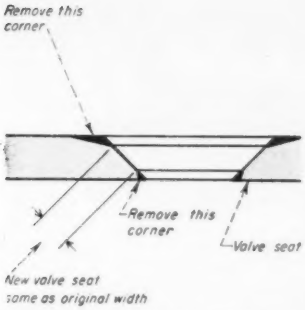
With clay-type filters, if there's little change with new oil, cause may be the filter itself. Clay often removes detergent additives along with sludge and dirt. If so, substitute mechanical filter, packed with waste, paper or metal disk. This filter doesn't usually remove the oil's soluble oxidation products.

Spring Troubles. Weak valve springs may cause a valve to "float," losing some or all compression and firing power. Springs get weak from normal use, also from corrosion, or rust from moisture in valve pockets. Moisture combines with sulfur in exhaust gas. Then weak acid solution forms, eats into springs. High cylinder temperatures also weaken valve spring.

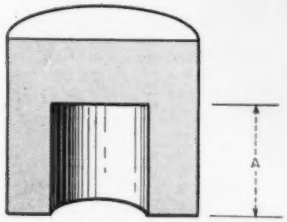
Check valve springs for nicks, or for chipped protective coating. If present, daub with suitable enamel to stop acid action.

Valve Stems. When engine shows signs of sticky valves, feed valve stems a little kerosene. Don't flood stem, but feed few drops often.

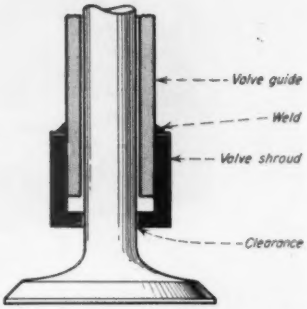
Some commercial solvents dissolve these gummy stem deposits while others are only for removed valve, which must



WIDE SEAT restricts flow. Remove corners so seat is back to original width

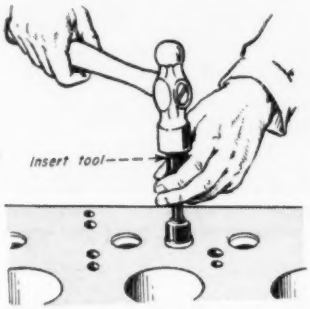


CAP on valve stem saves stem ends. But measure distance *A* shown here for wear



VALVE SHROUD protects stem from hot gas. Be sure to have enough clearance

SMALL valves of gasoline engines are quickly ground with this hand grinder



DRIVE home the cold valve seat into the hot engine head with this insert tool

be rinsed in cold water afterwards.

Bent and warped stems always cause trouble. Stems bend when valve head just touches piston crown, also from careless handling when valve is inserted. Prying open with a screwdriver bends valve. If trouble is from these causes, valve will have good seat on one side, but poor or no contact on other side. Check both valve stem and valve head for straightness.

Burned Valves. Look for burned valves if exhaust temperatures vary under steady load, or if there are excessive exhaust noises. Burned valves are from carbon particles impinging on valve seat or on valve head, also from not having enough tappet clearance, warped valve seat or excessive regrinding of valve face or valve seat.

Carbon gets on valve from dirty combustion spaces or piston head. Then carbon bits hold valve partly open. So "fire" gases rush through opening causing cracks and burning. This is more common with exhaust valves than inlet valves.

Valves with watercooled counterbore usually don't burn. If only the surface of valve head shows signs of burning, cause may be carbon-fouled engine.

When scraping carbon from combustion spaces and piston, use a soft-metal scraper to avoid scratching. Remove loose particles because they might stick to valve the moment engine starts. That causes more trouble than you had before cleaning.

Too small tappet clearances cause burned valves. Check clearances often and forget about super-quiet engine.

If valve seat insert is canted or not seating in counterbore, cooling transfer from jacket water is poor. Seat and valve will burn. If valve has been reground often, edges become sharp; soon the sharp edge burns.

Reseating Valves. The less hand grinding, the better. Why? Hand grinding causes a slight seat groove. Ground surfaces do not match when engine runs and metals expand.

If you have no special valve-seat cutter, use a milling cutter of correct angle. If seat is to be ground with a wheel, dress wheel to exact angle.

Hard scale on valves may be from fuels containing salts, leading to valve burning. Regrind with tool-post-electric grinder or a cutting tool. After grinding, test with pencil marks around ground valve. Put valve on its seat and turn about 45 deg while bearing down. All lines cut cleanly if job is OK.

Test valve stems for straightness in lathe. If stem has slight bend, straighten and regrind valve. If valve stem sticks from combustion sweeping around valve and hitting stem and guide, fit a shroud to guide.

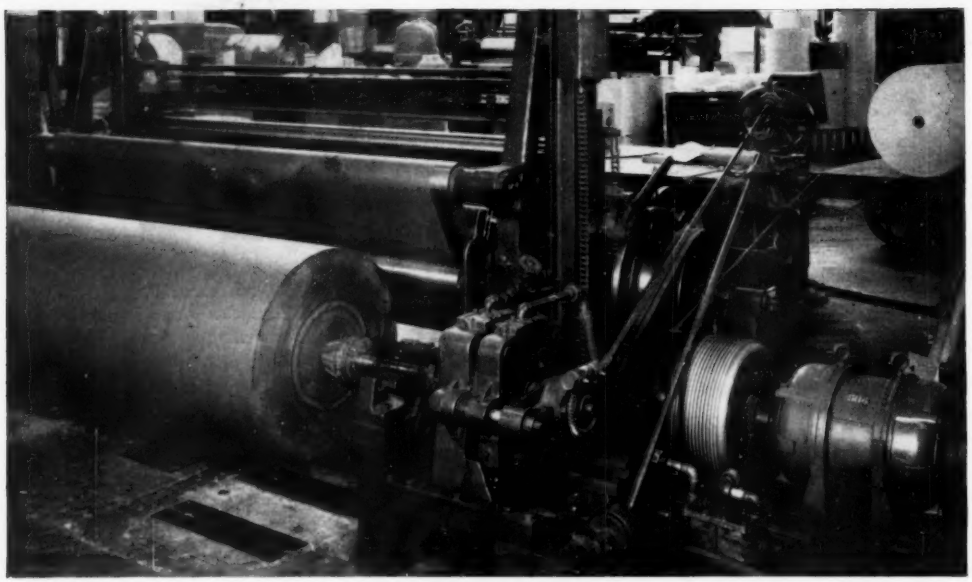
If old engine has had valve seat reground often, seat becomes wide, resisting gas leaving cylinder. Valve burning then may increase from back pressure. Solution is to cut back valve seat. First cut a new top edge with 15-deg cutter. Then trim away metal from bottom with 75-deg cutter until seat is original width. Use cutters with a pilot stem for this job.

Valve Inserts. If old valve insert won't come out, immerse cylinder head in hot water 30 minutes. Sometimes valve inserts can be forced out with a small puller or a drift.

To replace valve inserts, place head in boiling water 30 minutes while insert is in refrigerator or on dry ice. When replacing, see that counterbore is perfectly clean (wash with Stoddard's solvent and blow with air). Because inserts are a drive-shrink-fit, do operation quickly, while cylinder head is hot, and insert cold.

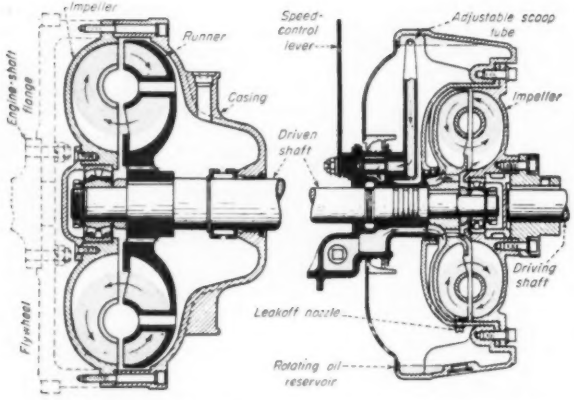
Valve stem caps reduce stem wear by taking force of rocker arm's thrust. If caps wear badly on inside, instead of transmitting motion directly to valve stem, it rests on lock or lock retainer. In time, these parts wear too, and lock or retaining ring may work loose. Then valve drops into cylinder.

Always check valve stem caps, and retainer and lock for wear. If shimmed cap, replace shims each overhaul.



PAPER SLITTER demands a constant torque and gives a high rolling inertia. Variable-speed hydraulic coupling permits quick acceleration or slow-speed running to inspect paper for flaws. Inching is done by engaging clutch on roll shaft

Let Fluid Drives Work for You



TRACTION-TYPE COUPLING

Fixed amount of oil contained in working circuit. When impeller turns, centrifugal force throws oil outward and forward into vanes of runner. Oil imparts energy to runner, circles back to impeller

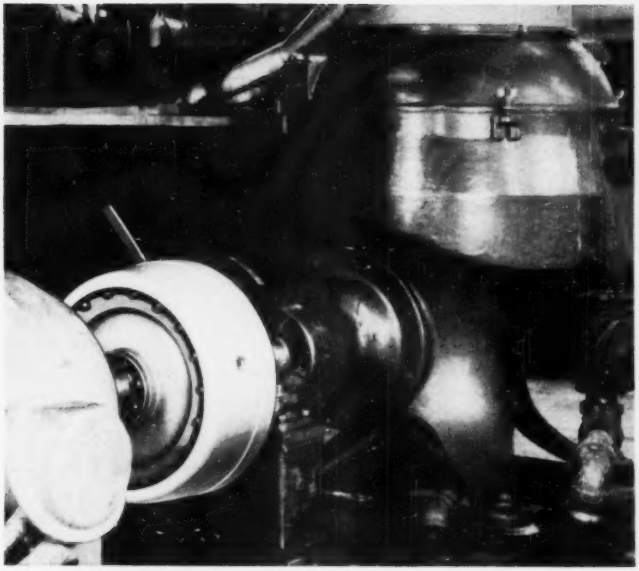
VARIABLE-SPEED COUPLING

Oil in working circuit is varied as load requires. Manually- or auto-operated, scoop takes the oil out of rotating reservoir, injects it into working circuit. Slip can be varied from 4 to 100% to suit

Heavy loads in starting, big changes in running speed, or just smooth, efficient power transmission . . . the oil drive fills these bills and more. Here are just a few cases where it paid off handsomely

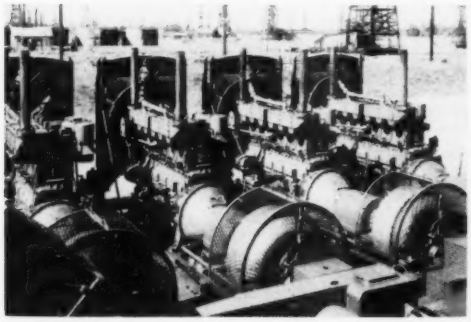
► WHEN YOU CHOOSE a motor for a job, you get one big enough to take care of the toughest part of that job. Usually that part is the start. But by spreading the starting torque out with a hydraulic coupling, you can pick your motor to fit running instead of starting requirements. That means a big saving in first cost. A simple general-purpose squirrel-cage motor can be used where a higher-cost lower-efficiency motor is otherwise needed.

The same goes for internal combustion engines. A fluid drive between a

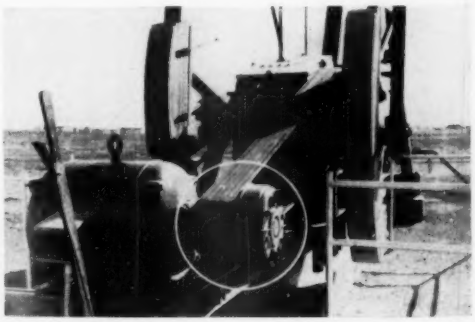


CENTRIFUGAL SEPARATOR is started with motor running at full speed and 100% slip in clutch. Acceleration is controlled by manual operation of scoop-control lever

CONSTANT TRACTION coupling absorbs shock of tramp iron caught in coal screw



FLUID-DRIVEN diesels run compounded deepwell mud pumps and pipe draw-works. Coupling oil has own cooling system



HEAVY STARTING LOAD leveled out on oil-field pump. Motor selection now based on running load, not starting requirement

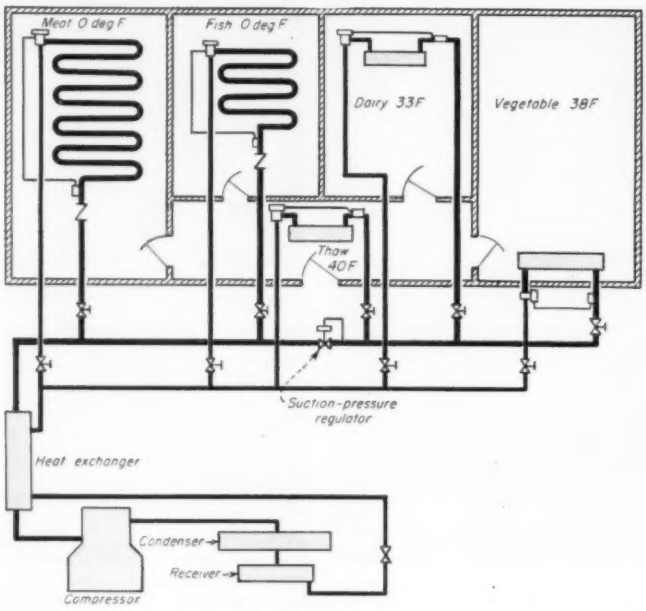
diesel and a stalled load will slip, giving the effect of *steam* power, yet prevent engine from stalling, too.

The applications are almost unlimited. Paper winders, centrifugal separators, coal screw conveyors, oil-field pumps and mud pumps . . . these are just a few. Some more are: boiler feed pumps, fans, reciprocating pumps and compressors, rotary kilns and ball mills, lathes and hoists, and many others. In each case the fluid drive *cushions* the load to the driving element, and vice versa. The shock of change is removed.

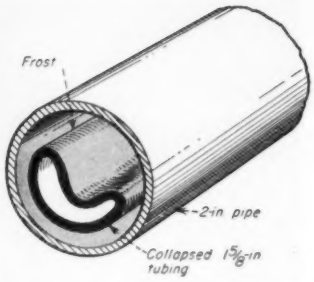
Built for almost any power from ½ hp up, fluid drives are made in two basic designs, the traction type and the variable-speed scoop-control type (see sketches, facing page). The traction, or constant-speed, drive has a fixed amount of oil in the working circuit, so it transmits a uniform amount of power depending on speed of impeller. Use it only on loads that don't need close control of varying speeds.

The variable-speed coupling has a rotating oil reservoir from which a tube adds or subtracts oil from the working circuit to suit the load. The less oil in the working circuit, the more slip between motor and load. Thus a controlling factor is introduced to handle foreseen and unforeseen changes in speed or torque.

This quality makes the variable-speed coupling suitable for stepless speed variation, no-load starting of motors, torque limiting and control, acceleration control, shock absorbing, and for clutching *on-off* cycles. But before picking a fluid drive to suit your needs, consult a manufacturer. He knows them best.



1 Meat room in this hotel plant would not pull below 32 F after room had been defrosted. But why did other three rooms with same common liquid line work OK?



2 Collapsed tubing inside 2-in. pipe is from condensed frost on outside

Shooting

By **DICK GODFREY**
Refrigeration Engineer
John H Dulaney & Sons

► SUMMER is the busiest season for shooting trouble because of numerous comfort air-conditioning installations. Refrigerated storage rooms also have more trouble because of high humidities and peak-load operation in hot weather. But winter also gives us worrisome headaches.

First Problem. Here's a problem came up last winter. The engineer of a medium-sized hotel called me in because he couldn't bring the temperature down in his meat room. He said temperatures were OK until he shut the room down for cleaning. When he turned the refrigeration on in that room again, it wouldn't pull below 32 F. Besides, it had taken too long to get even that far. Rest of system had been operating while the meat room was shut off but it was still all right, Fig. 1.

Possible Causes. My first thought had been that there might be moisture in the system. Moisture deposited as ice inside the coils goes into circulation when a room is warmed up, and causes plenty trouble. But why were the other rooms operating perfectly? Besides, with a common liquid line to all boxes, this would be unlikely.

Next suspected point was the expansion valve. But the coils showed frost all the way around to the thermal bulb, indicating that this valve was acting properly. I examined the valve. It was OK. Next check was to see that liquid line was not blocked ahead of the expansion valve.

I've seen packless valves cause a restriction when the inner valve stem becomes upset at the end. That was because someone used a wrench on the handwheel. Such an upset prevents the valve opening fully. Inspecting the shutoff valve showed it was all right. Then opening the king valve, while bonnet was off the shutoff valve, showed sufficient volume there.

I finally decided nothing fitted the symptoms except a blocked suction. Checking the suction valve showed it was all right. Then I started removing insulation from the suction line, starting at the coil's end. I worked toward the point where it joined the suction main.

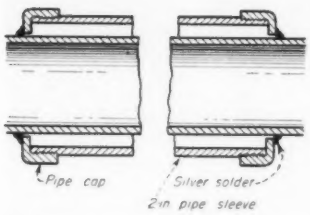
A restriction is often indicated by frosting on the line at restriction. This is from expansion on the low side of blocked section. But visual inspection yielded nothing, so I started taking the suction line apart, joint by joint. Then I ran a small piece of tubing through each section of pipe.

Trouble Found. Suction line from meat room passed through insulated wall to suction main. Copper tubing was 1⅝ in. and ran through a 2-in. pipe sleeve in the wall. Drilled pipe caps were threaded onto each end of the sleeve. This might have been all right had the sleeve been packed.

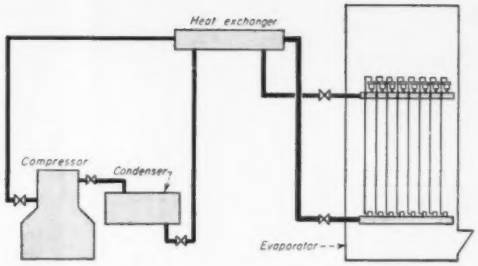
With no packing, frost had built up on the tubing inside the sleeve. Finally, the built-up frost created enough pressure to collapse the tubing, Fig. 2. The room had maintained temperatures all right because the collapsed tubing passed enough gas for the light holding load. But when the room was turned on after defrosting, high temperature caused too great a load for the restricted opening. It just couldn't keep up with the refrigeration requirements, so it caused the slow pull-down.

Easy Repair. I repaired it very simply. First I cut out the bad section of tubing, then inserted a new piece of tubing with slip couplings. I silver-soldered the pipe caps to the tubing, Fig. 3. With space between two tubes made air tight, there would be no moisture-laden air to condense in this space. To prevent it happening again, I made same changes on other low-temperature boxes, for good measure.

Second Problem. The engineer in this



3 Soldered opening around the pipe cap closed up space to keep out moist air



4 Oil carried over into evaporator coils and remained in low spots as refrigerant velocity was low, vapor superheated

Refrigeration Troubles

Why didn't one room pull down after it was defrosted for cleaning?
If moisture in system was fault, why were other rooms OK?
Why did another plant run fine, then temperatures start dropping?
With everyone adding crankcase oil, where was oil going?

plant has since learned a great deal about refrigeration. He was prompted, no doubt, by the trouble I was called in to solve.

There was a 50-hp Freon-12 compressor. It served a finned-tube evaporator unit, with eight refrigerant circuits, each with its own expansion valve, Fig. 4. My company had installed the job. We ran the acceptance tests and turned the plant over to the customer's engineering staff to operate. It ran fine for some months.

Trouble. Then the customer reported the plant had lost most of its cooling capacity. That's when I was sent up to investigate. Plant's operating engineer was a competent man. His engine room sparkled like a ship's. Further, he had read up on the system when the unit was installed. Besides, this installation was his "baby".

He gave me a detailed account of all that had been done to the system. First clue to cause of trouble came when he said that the shift operators had orders to check the oil level in compressor each shift. They were to add oil as necessary. I then had a glimmering of why the capacity reduced. And my first check of the machine confirmed it.

Finding Fault. First, I took the temperature of the suction gas leaving the evaporator. It had 20 degrees of superheat. After inquiring, the operating engineer recalled that he had closed in the expansion valves shortly after he took over. Reason was the compressor cylinder's bottoms had sweated on low-suction pressures. So he feared that liquid was coming back to the machine.

I opened the expansion valves until there was about two degrees superheat. Then I watched the compressor-oil level. As I had expected, it began to rise quite sharply. When it reached the top of the bull's-eye oil-sight, I closed the liquid valve and stopped the compressor. Then I shut the service valves, vented the crankcase pressure, and drained out oil until the level had fallen to the bottom of the bull's-eye.

Next, I put the compressor back in service and repeated the operation when the oil again reached top of bull's-eye. I kept this up until the oil level stopped building up in the crankcase. By then I had removed over 25 gallons of oil!! Tests showed that the system was back to full refrigeration capacity and there was nothing further wrong.

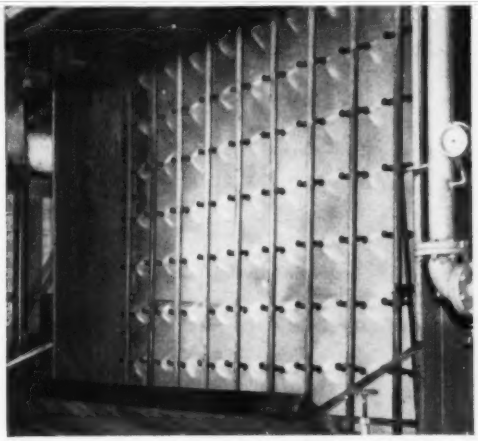
What OE Overlooked. He knew oil and Freon-12 are miscible and, therefore, oil is expected to circulate with the refrigerant. He didn't realize that oil will remain in low parts of evaporator if refrigerant velocity is low, and vapor is too dry (superheated).

In the evaporator coils, oil acts as an insulator. It prevents proper heat transfer from air to the refrigerant, through the tube wall. Further, oil raises the boiling point of F-12 one degree for each 5% of oil present.

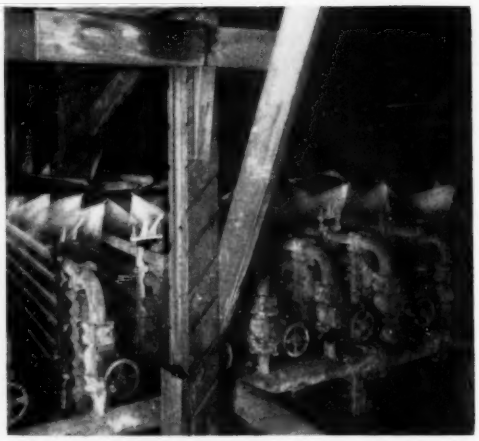
Adding Oil. Always be careful when adding oil to a Freon compressor. This holds especially true if you don't know where the oil is going. Overfilling the crankcase often causes carryover due to excessive splashing. Follow the manufacturer's directions about oil level carefully.

Setting the expansion valves to allow a slight liquid slopover to heat exchanger is a good way to insure oil returning to compressor. Keeping proper charge of refrigerant in the system is important, too. And, once again, do not add oil if it can be avoided.

Even the best operator runs against a tough problem at times. During my trouble-shooting days I had my fill of them. It's just a case of readiny symptoms correctly. But once you know your equipment, impending troubles usually give you warning in time.



AIR-WASHER sprays handling water at 25 psi, 65 F. Be careful to keep rust out of spray water because nozzles may plug up



COIL CONDENSERS in meat-packing plant are cooled by water sprays. Clean nozzles keep head pressures down, cut your costs

Don't let rust ruin your air-conditioning or refrigeration system. Learn today how to . . .

Chase Rust From Air-Conditioning Units

► ONE SURE WAY to foul up your air-conditioning system is to let rust get the better of it. You'll have trouble in many parts and be plenty sorry. But by using your head you can put the brakes on rust.

Water Supply. Pumps, pipes, air washers, condensers and cooling towers all handle water in your system. If the water is corrosive, and many natural waters are, all these parts may suffer. You may also get almost the same kind of trouble where different metals are joined together in air washers and other units.

Easiest way to stop rust is by treating water with chemicals. Add an alkali to raise pH to 8.5. Feed into air washer's spray water. Using a chemical feed pump that runs when washer circulating pump does is good for this job.

For more protection, feed sodium dichromate to washer along with the alkali. Chromate forms a thin film over metal surfaces, guards against rusting.

Intermittent feed from a pump is best because spray water picks up carbon dioxide from the air. pH of water falls, meaning that it becomes more corrosive. With chemicals fed while spray pump runs, pH stays close to 8.5 and there's little danger of corrosion. Feed alkali and chromate at same time with the same pump.

Air Ducts. Paints do best protection job here. Red lead is topnotch for steel ducts exposed to atmospheric corrosion. Use three coats. Tint second coat to a light brown color with carbon black. Finish coat may be one of several that have proven themselves in service

These are red iron oxide paint (Federal Spec TT-P-31), red lead tinted brown or black with paint made to Federal Spec TT-P-61, and light tinted paint or white paint made to Federal Spec TT-P-40. Chlorinated rubber-base paint (Federal Spec TT-P-91) is good finish coat where strong alkaline water or corrosive gas contacts duct and injures regular paint. Don't use rubber-base paint without first putting on two priming coats of red lead. Or zinc chromate paint may be used for primer.

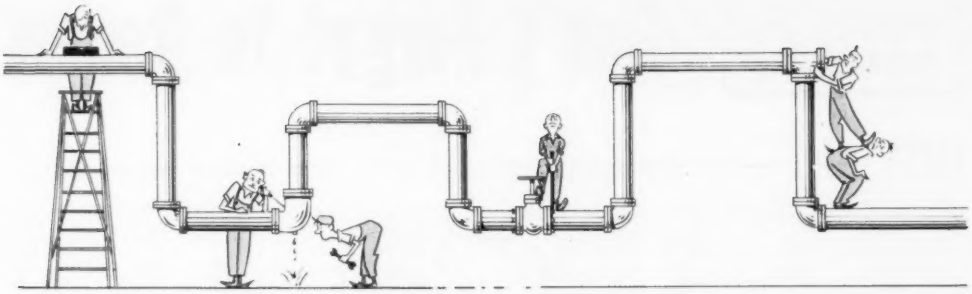
Caution. Before buying chemicals and a feeder for your air-conditioning system, check with state and Federal authorities. Some states require that air-washer water meet drinking-water standards, even though system serves an industrial load. U.S. Dept of Agriculture meat inspection division won't allow chromates in air washers supplying air that contacts food.

Be extremely careful when measuring out chemicals to feed air washers. Many chemicals for rust, scale and slime control are injurious when taken in relatively large doses.

Scale. Some water not only rusts your equipment; it also forms scale in air washers, cooling towers and evaporative condensers. Evaporation causes salts in water to concentrate and you get scale much as in a boiler. Scale can be just as harmful as rust.

Stop scale with zeolite treatment, surface-active materials (called polyphosphates), bleeding or blowing down water from system. Don't use any of these methods without first calling in a water specialist. He'll steer you straight on what's best for your plant.

Photos courtesy of Yarnall-Waring Co



Last-Minute Checks of Heating Line

Planning Any Summer Maintenance?

Late spring is a good time to work out your summer maintenance schedule. You've still got steam up in the boiler for early morning, evening loads, and you can run a lot of checks on supply system without upsetting anybody. What is more, you can see what's happening.

Are Pipelines Properly Graded?

A downward pitch on the steam main from header to connections with the return gives best results. Then the return line, except wet returns, ought to continue to slope right down to the boiler. Did you notice if you had to carry higher pressures on the boiler than in other years? Water-logged distribution mains could be the cause. Check grades with a level or a line. Don't measure from the floors. They're not always level.

Have You Got Good Venting?

Remember any complaints you've had from building sections slow to heat up or never quite warm enough? Feel the end of the main and if it's not heating up fast enough, chances are it's not vented or trapped right. Plan on it for summer. If you have dry return mains looping under doors or beams, check to see if there are air loops to vent air. Notice if there's evidence of water hammer at end of steam main or in the last few risers coming off it when heat is coming into the system. An undersized or dirty drip tap will back up water. Check these traps now. Flush and clean strainers if you've got them.

How Do Branch Lines Look?

You can check pitch of branches best when piping is hot. Riser expansion sometimes pushes back against branch line to produce a back grading. Correct with drip traps. If you do have a drip through a trap, put in a cooling leg at least four feet long between riser and trap. Otherwise, condensate can get so hot it prevents trap opening properly. Usually short branches one size larger than the risers that pitch back to the main need no drip fittings. But branches pitched down from the main have to be dripped at the heels of the risers to keep circulation free.

Are Valve Stems Packed, Flanges Tight?

All those small leaks you noticed through the heating season should be tagged with a colored card or other marker, so you won't forget to repack valves, check gaskets.

How Are Piping Anchors?

Anchors may slip or expansion joints bind if not oiled. The only time you can actually see how the expansion joint behaves is when you use your system. Now's your chance.

How About Trap Operation?

With your heating system still under load you can run checks on trap operation. Take your boiler return trap. See if it vents air freely when heating up. If you notice water getting out the air vent, repairs are in order. Are you sure the return trap is set high enough above the boiler-water level? If not, you'll always have problems.

Planning to Revamp Piping?

Take a good look at your present piping setup. If you've got an old building look for cross connections, bypasses, dead ends that have long since lost any relationship to your operation. Every unnecessary bend, tee or elbow should come out. All they do is increase heat loss. If they form kinks, or pockets they either add to pressure drop in the system or actually restrict flow.

Many a plant just shuts off the valve supplying an unused branch and forgets it. Sometimes a blank flange goes into one of the pipe joints. But the right thing to do is remove as much of the piping upstream as possible and fit in a plug or a blind flange in the live main.

Too Many Fittings?

Ever see vertical and horizontal piping runs set on the same wall with one pipe jumping another? Every time it happens you'll find four elbows, and for a 4-in. pipe that's equivalent to an extra run of 32 ft. It's always a good rule to fit all vertical pipes snug against the wall. Then carry the horizontal ones out a foot or so from the wall. Usually there's enough head room to allow this.

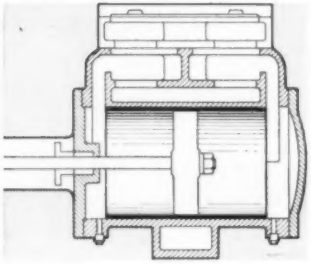
What About Expansion?

If you do revamp with the idea of shortening all piping, don't go overboard. Short pipe runs are always ideal but they also mean a rigid piping layout. So be sure you allow for expansion. Never use elbows as a substitute for bends. If you've got room, put in bends, and the easier the better.

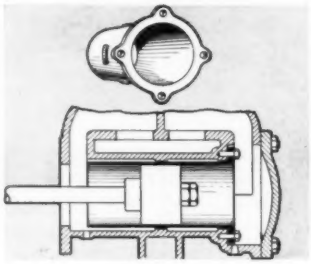
OPERATORS' NOTEBOOK 53

Don't Forget to Renew

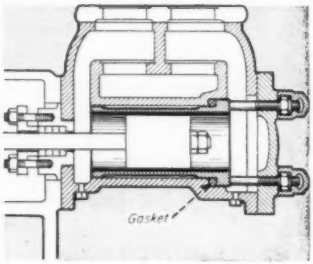
TYPES



PRESSED liner is thin sleeve that is a pressed fit into cylinder bore. Material is bronze, monel, cast iron or others



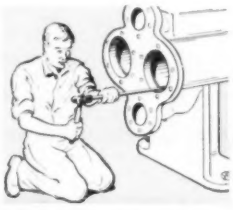
REMOVABLE liner is held by four bolts and is centered by four lugs. Easy to renew because it is not a pressed fit



REMOVABLE cylinder with bronze liner is held by binder bolts through cylinder head against gasket to prevent leakage

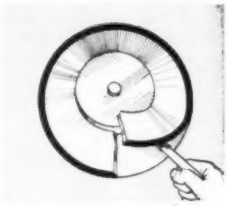
REMOVING PRESSED LINER

WEAR is on bottom of horizontal liner. Unless renewed, the piston rides on casting



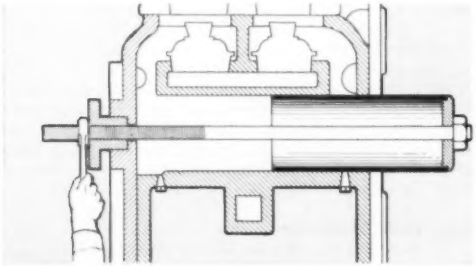
SPLIT liner with chisel bar along bottom, where the metal is already thin from wear

CAUTION! It's easy to damage cylinder casting under the liner. Split only the liner

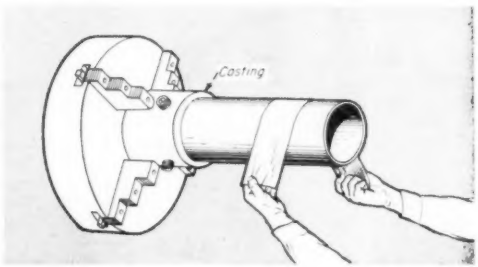


COLLAPSE the split liner with chisel bar. This isn't easy, also depends on the material

PRESSING IN NEW LINER



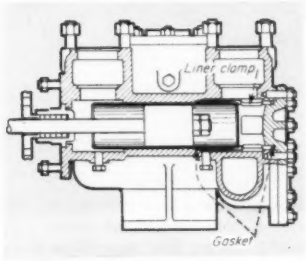
PRESS new liner into cylinder gradually like this. First clean cylinder and oil liners outside. If liner is tight after first few inches, remove it before it gets stuck tightly, for good



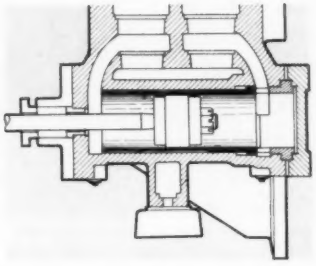
POLISH liner outside with coarse grinding cloth by holding it in lathe like this. If inside and outside micrometers are handy, polish liner so it is only about 0.0005 in. larger than cylinder

Your Reciprocating Pump Liners

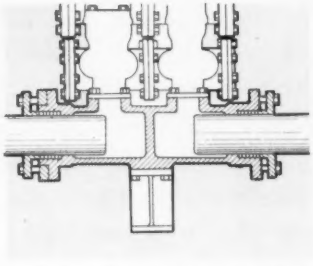
By **STEVE ELONKA**, *Associate Editor*



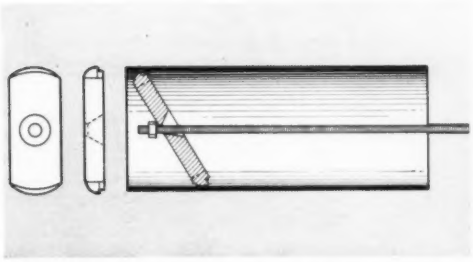
REMOVABLE liner with clamp (ported distance piece) between cylinder head and liner. Cylinder bolts support the liner



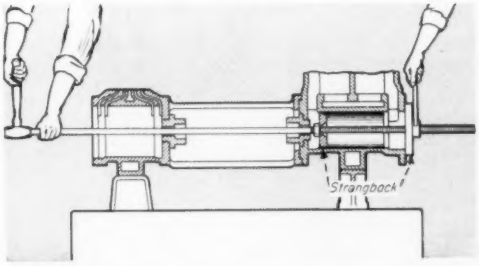
REMOVABLE liner with double shoulders, held by distance piece against cylinder head. Small bearing surface on cylinder



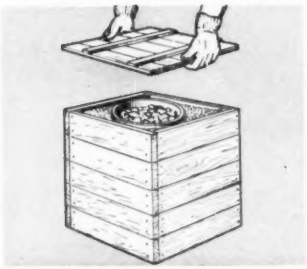
NO LINER. Whether outside-packed (like this opposed plunger pump) or inside-packed type, plunger takes all the wear



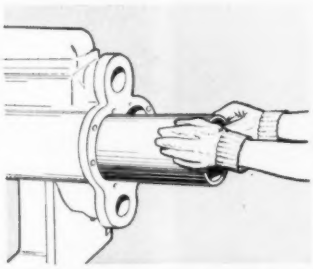
PULL worn liner in one piece. It's much easier but you must have strongback shown to hook in back of liner. Turn groove in lathe to fit liner; then grind back edges round as shown



STRONGBACK against open cylinder keeps steady strain on liner while small sledge pounding against bar bumps it out. This method is much quicker and easier than splitting liner



SHRINK liner with Dry Ice. Place in wooden box and pack with sawdust. Break up Dry Ice and fill inside of the liner



WEAR GLOVES, slide liner in fast. You may have to tap liner with mallet. Bag of Dry Ice inside liner keeps it shrunk

WHAT IS DRY ICE?

This is solid carbon dioxide, (CO_2), and is 109 F below zero. It's solid in 10-in. cubes, weighing 50 lb. Count on about 0.001-in. shrinkage per inch of liner diameter. To keep liner expanding while fitting into cylinder, place bag of broken-up Dry Ice inside liner. *Caution!* CO_2 displaces air, so ventilate working spaces well. Also, avoid frostbite by covering bare skin.

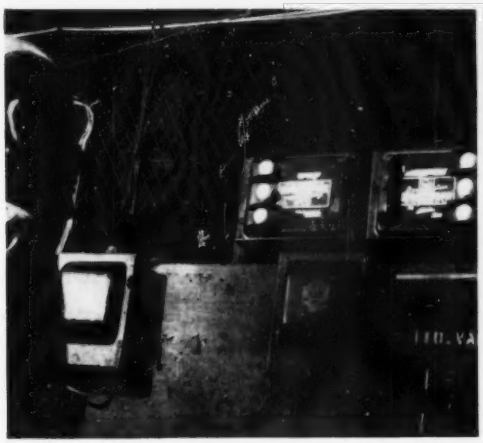
Grounds play havoc with hot production schedules. Here's how they're tracked down fast without shutting off power at Walter Kidde & Co, Inc., Belleville, N. J. Let's follow through with R J Folcke, supt of maintenance, and John Soyka, chief electrician, to see how they go about . . .

1 From his desk, Folcke has good view of production line at his plant. When grief crops up, he saves valuable time getting to the scene. But experienced hands are helped by trouble-sniffing instruments, especially when the power grounds out

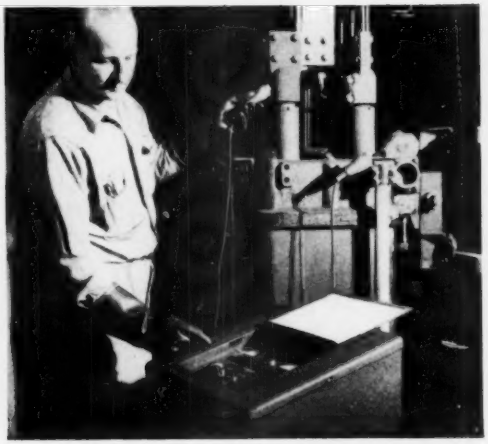
...Spotting Grounds on

4 With sensitive induction-type impulse receiver, John traces signal through metalclad switchgear on grounded line. Portable detector unit will pick up impulse as small as ½ amp

5 Signal snooper tracks signal through branch circuit box feeding big press. While probe follows pulse, all machinery can be left on line. This cuts down time, saves cash

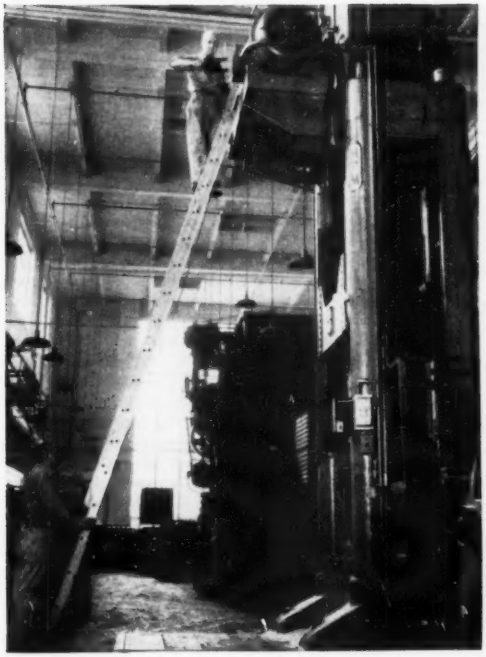


2 Light on the indicator panel shows John Soyka which phase has gone to ground. Quick action and new ground-spotting instrument will have this one dug out in a matter of minutes

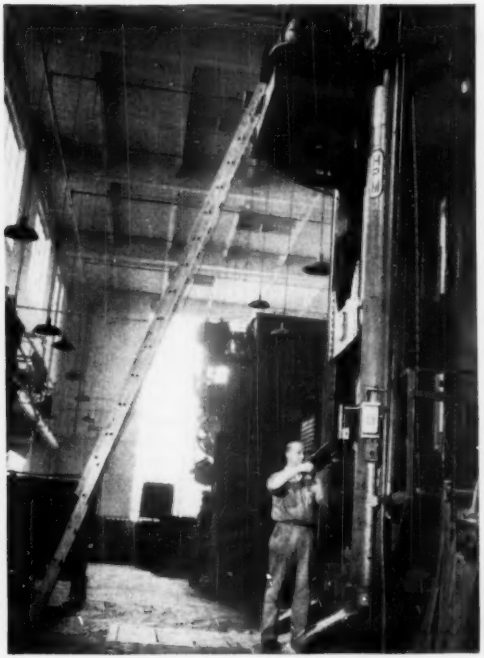


3 Ground-detector impulse unit is clamped to ungrounded phase at bus. Signal current is superimposed on grounded line all the way down to trouble points. Now let's follow it up

An Ungrounded System



6 Logical place for ground is in motor of vertical press, so John and his helper haul out ladder and take a look. As no signal is detected up here, they have to search farther



7 Back down to control transformer. This time pulse comes through. Machine is shut down for fast insulation repair, then put back on line . . . time and cash lost is cut to bone

TAMPERING WITH voltage regulators to meet load conditions will cause wasted time, erratic operation and power outages

Are You Guilty of—Regulitis?

You are if you change voltage-regulator settings oftener than two or three times a year. Regulitis is costly — so here's how to cut it out

By **R H KUTSCHER**, *District Mgr, Electric Machinery Mfg Co*

► THERE'S NO EXCUSE for *regulitis*—the habit of changing the settings on voltage regulators too often. Any operator who adjusts his regulators more than two or three times a year is guilty of this "occupational disease."

This bad habit is found chiefly in ac power plants smaller than 3000 kw where generators are paralleled. Of several dozen I've visited, about 90% suffered from regulitis. Some operators were making adjustments several times a week, and some as often as twice a day. Tampering with voltage regulators to meet load conditions will cause wasted time, erratic operation and power outages.

Voltage regulators are designed to *automatically* control voltage and *automatically* control division of reactive load when two or more ac generators are used in parallel. Let them do the job they were put there to do.

To accomplish this, adjust the regulators once and for all to control voltage and divide reactive load automatically regardless of load conditions. Then leave them alone. Here's one way of doing it:

1. Check performance of each prime mover's governor (see sample data sheet). Set governor for rated speed of unit at full load when working alone. Percent speed droop from no load to full load should be same for each unit (usually 2 to 5%). Governors will then automatically divide power (kilowatt) load between paralleled units and control speed.

2. Check performance of each voltage regulator. Set regulator for rated voltage at full load when each unit is operating alone. Percent voltage droop from no load to full load should be same for all units (usually 2 to 5%). Regulators will then automatically divide reactive (kilovar) load and will also control voltage.

Here's a better way. It requires more care to prevent mistakes, but is actually more convenient. It is a way of conducting required tests during normal operation, while plant load exceeds the rating of the unit to be checked:

1. Adjust governor setting so unit tested is carrying full kw load at rated speed.

2. *For remainder of test, leave governor setting of unit being tested unchanged.*

3. Only the unit tested should be voltage regulator controlled. Others must be rheostat controlled, manually.

4. Adjust the voltage regulator of the unit under test and rheostats of other units so that unit tested is operating at the rated kva as well as the kw load.

(*Continued on page* 216)

SAMPLE DATA SHEET

Governor and Voltage Regulator Load Characteristics

Unit No.	1	2
Rated rpm	360	300
Check on governor adjustment:		
Full load rpm	360	300
No load rpm	370	309
Droop in rpm	10	9
Droop % of full load rpm	2.8	3.0
Check on voltage-regulator adjustment		
Rated voltage	2400	2400
Voltage at full load, full load rpm	2400	2400
Voltage at no load, no load rpm	2472	2479
Droop in volts	72	79
Droop % of full rated volts	3.0	3.3

Unit should be at normal operating temperature before test is begun. Other units must be shut down or run mechanically.

While making voltage regulator check, governor settings must be left the same as they were for the governor check.

Finding motor faults fast saves you cash and care. Here's the second of the quickie charts by motor expert S Spence of Cheshire, England. This one gives you the symptom, cause and cure of . . .

. . . Synchronous Motor Faults

SYMPTOM	POSSIBLE CAUSE OF TROUBLE: CURE
MOTOR WON'T START OR COME TO SPEED	
	1 Low starting voltage; a 15% supply voltage drop can prevent starting. Higher voltage tap, mechanical auxiliary starting may do trick. If reactors are used for starting, they may be too big—cutting starting current too much.
	2 Rotor may be tied in to direct-connected exciter during starting. This increases required starting torque. Best bet: leave rotor field circuit open and in parallel with discharge resistor. Close in when motor is near synchronous speed
	3 Open in stator circuit or field starting winding
	4 Starting load too big. Raise power, cut load
LOUD AND SOFT HUMMING: HUNTING	
	1 Alternator speed may be changing. Improve speed regulation of prime mover running alternator that feeds motor
	2 Rapid changes in load. If frequent, keep motor overexcited (limited by heat-up factor)
	3 Voltage and frequency variations. Could be due to: (a) short circuit in supply (b) wrong excitation (c) mechanical overloading
	4 You may be weakening excitation at no-load to improve power factor. Salient-pole-type motors can take lowered excitation up to about 20% of unity pf without pulling out. Avoid large excitation reduction
MOTOR CIRCUIT-BREAKER TRIPS	
	1 Line surge. Restart when line is cleared
	2 Low voltage because of supply fault

SYMPTOM	POSSIBLE CAUSE OF TROUBLE: CURE
MOTOR CIRCUIT-BREAKER TRIPS *(cont)*	
	3 Excitation stops because of open circuit in motor field, rheostat or wiring between exciter and motor field. Seen by exciter ammeter reading
	4 Exciter not working (seen by lack of voltmeter reading). Check exciter brushes, field coils, armature, rheostat to trace and repair fault
MOTOR WON'T SYNCHRONIZE	
	1 Too much load torque during speed-up. With a pump, a partially closed valve could cause this ill
	2 Starting voltage too low. Higher voltage tap is the answer
	3 High resistance in damper (amortisseur) winding
	4 Faulty exciter brushes
	5 Reversed field polarity; stator current doesn't drop to minimum at unity power factor after exciter is connected. Repeat starting cycle with correct polarity
	6 Current surges when full supply voltage is applied to field-excited motor. Remedy by selecting suitable excitation value to give *over-excitation* during start. Then switch from START to RUN without delay
OVERHEATING OF MOTOR FRAME	
	1 Over-excitation. To cure, reduce excitation until stator current comes down and tries to build up again. This betters motor pf, but reduces system pf
	2 High resistance fault to ground in winding
	3 Short circuit in turns or coils of winding
	(For more causes of overheating of motor frame, see POWER, March 1952 issue, page 124.)

PRACTICAL IDEAS...*here's the trading post for your*

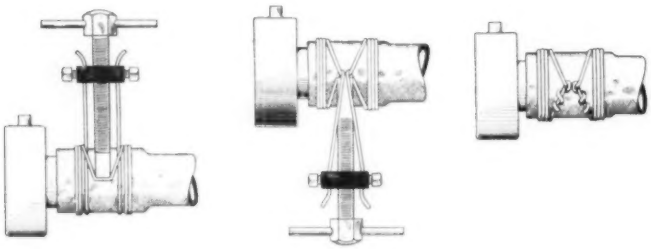
OIL SETTLER CLEARS UP OIL

WE USE No. 10 pure mineral oil in various motors, compressors and other machinery around our plant. It takes about three months for the oil to lose its color, so we then replace all oil with new.

Used oil is dumped into small settling tank shown in photo. This is an old copper container, with two faucets. One is near the bottom and the other four inches higher. There are a few inches of water in tank at all times.

After oil settles for three months, solids and water settle to the bottom. Then oil regains its color and we use it again. Once a year we drain out the water and clean out this settling tank. Our bearings always have clean oil and there is very little makeup oil needed.

A J MILLER *Buffalo, N. Y.*

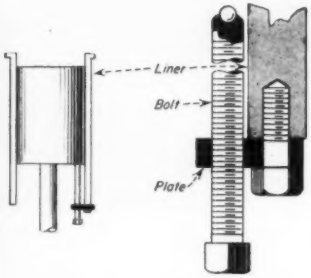


HOSE CLAMP HANDY IN A PINCH

SOMEONE IS ALWAYS LOOKING for a hose clamp around our chemical plant. While we carry a stock, I also made up the handy gadget, in sketch, for twisting wire around any size hose.

This is a $\frac{1}{2}$-inch bolt that screws into a piece of flat stock used for a yoke. Yoke has two setscrews for holding the wire while it is wrapped around the hose. This draws the wire tight and folds the two ends back so the clamp can be released. Then wire ends are twisted around, as shown, for holding permanently in place. This clamp has come to the rescue many times.

J A STEWART *Houston, Texas*



Diesel Piston Jack

REMOVING AND REPLACING a cylinder head on a large valve-in-head diesel engine is a good day's work. To check or replace a defective connecting-rod bearing takes time also. When rolling out the upper half, you have to remove the cylinder head and lift the piston's weight off the shaft.

All this work didn't make sense, so we made a jack screw, sketch. Screw raises piston from inside the crankcase and holds piston's weight. Now we don't have to touch the cylinder head when changing a rod bearing.

First, jack the crank in position needed to work on the crank bearing. Then, bolt jack to liner's bottom or to any other convenient part under the piston. For some diesels, plate in sketch might have to be changed to angle iron.

Screw bolt up against piston to hold it in place. Then loosen the connecting-rod bolts and screw up on the jack until it takes weight off the piston and rod. On large engines, you may have to use jack on either side of cylinder.

F J ARDOLINO *Brooklyn, N. Y.*

EDITOR'S NOTE: *All large, vertical, triple-expansion marine steam engines have place for jack on crosshead guides.*

Brazing Drill to Drill Rod

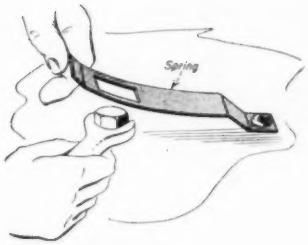
WE HAD OCCASION to take temperature readings at different parts of our chain grates and stoker. We could not get a drill long enough to drill holes in cast-alloy metal for thermocouples. So I obtained a piece of drill rod same diameter as drill, inserted drill in small V-block, drill rod in another V-block.

I packed the drill with wet asbestos cement to localize heat, then spaced rods $\frac{1}{8}$ in. apart. After brazing, I ground off excess bronze. The brazing held up.

A ROCKLIN *Chicago, Ill.*

operating and maintenance short cuts

STEVE ELONKA, *Associate Editor*

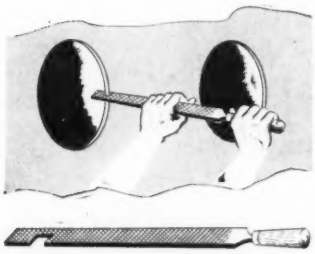


Stop That Nut

A NUT OFTEN has to be adjusted several times a day, yet must "stay put" until next adjustment. This can easily be assured with a spring safety, sketch. In use, merely lift up the spring with a finger while adjusting nut with an open-end wrench. Releasing the spring locks the nut again.

Any spring material will do for the safety. Just make sure spring is long enough so it does not set when it is actuated. Design shown gives a positive and completely troublefree device.

S V WORTH *Brooklyn, N. Y.*



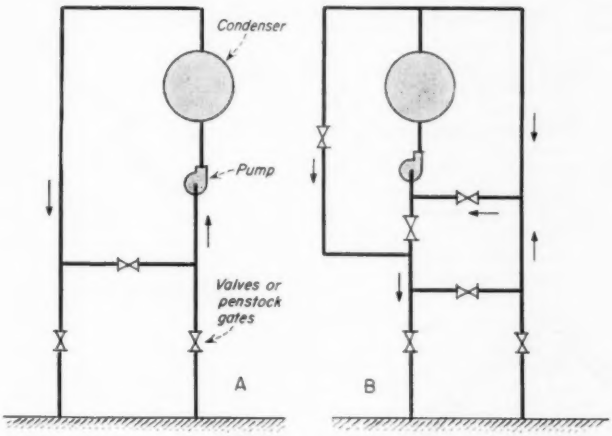
Handhole Scraper

WE ALWAYS HAD TROUBLE cleaning broken gaskets and scale from boiler headers inside surface that handhole plates seat against. I discovered the job is easy by grinding a one-inch-long slot about $\frac{5}{8}$-inch deep near the end of an old mill file.

Be sure to have groove at least as deep as width of gasket.

Before replacing handhole plates, run this scraper around all holes so the inside is scraped. Job can be done without standing on your ear because scraper is held at 90 deg to header.

M HEGE *Clinton, Iowa*



HERE'S HOW TO KILL MARINE GROWTH

MARINE ACCUMULATIONS or mussel growth often affect large power plants in estuaries. Mussel growth in cooling-water lines and culverts slows water flow. Unless you prevent accumulation, look for serious trouble. Such growths even take place in condenser water spaces and end boxes.

Various cures have been tried: chemical treatment of water; raising temperature of water; periodical changing over of flow in pipelines and culverts; inserting a cleaning ball in pipelines.

Raising temperature is effective, but you must have right pipe-work cross-connections so intake and discharge pipes or culverts can be transposed. Have bypass or recirculating connections as near sea end of pipelines as possible. Circulate heated sea-water repeatedly until temperature is reached that's fatal to young mussels and spawn.

Recirculate by bypassing discharge back to inlet until you get right temperature. Then maintain it by regulating amount bypassed and amount of cold inlet water added. Then intake and discharge pipes or culverts between the condenser and bypass will have desired temperature. Water in remainder of discharge pipe or culvert will gradually be raised to required temperature also, as surplus not being bypassed finds its way to discharge end and expels cooler water from the pipe.

Time taken to complete process depends largely on length of pipework or culvert, position of bypass, and time needed to attain right temperature. Mussels usually aren't dislodged immediately because it may be some days before they decompose. Then they easily fall away.

Mussels cannot live in 100-120 F sea water for more than about one hour. Time for survival at any temperature appears to increase with the size (or age) of mussel. For one about 3 cm in length, 110 F is fatal after about a half hour's exposure. Sketches *A* and *B* show two layouts for recirculating cooling water. *B* is better but costs more.

F H CARR *Shipley, Eng.*

Aluminum Conductors Successfully Tinned

SINGLE STRANDS of aluminum can be tinned as follows. First, separate and clean each strand, then get a sheet of copper about 1 in. square and $\frac{1}{4}$ in. thick. Drill a series of holes in copper sheet of about $1\frac{1}{2}$ times wire diameter.

Tin the plate and interior of holes, using a solder compound of 90% tin and 10% zinc. Fit plate with a handle that's covered with insulation so it's easily held.

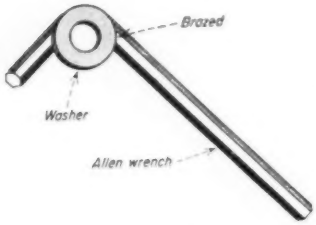
Put wires through holes in copper plate while holding blow-torch flame on plate. Hot air from this flame preheats aluminum wires. Then copper plate heats up quickly and holds heat at

Begins on page 136

soldering temperature. Move copper plate backwards and forwards along the wires. Run on more solder as required, melting it on top of the copper plate. By this means the whole surface of wires is tinned.

Recommended solder of 90% tin and 10% zinc becomes fully liquid at 392 F, so there is no danger of overheating. The movement of wires through copper plate breaks up the film of aluminum oxide, which forms so quickly on aluminum. Method is simple and handy.

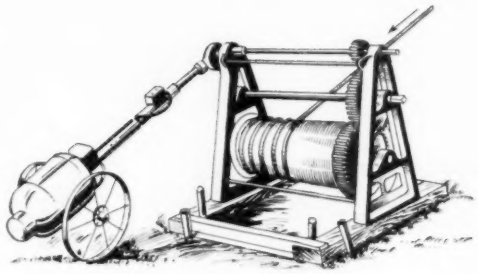
W E WARNER
Woodford Green, England



Hollow Screw Wrenches

A HANDY WAY to keep a set of hollow-head screw wrenches for ready use is shown in sketch. Braze a small washer on bend of each wrench. Then slip washers onto a hook on wall rack, a key ring or similar holder.

T TRAIL *Catonsville, Md.*



EMERGENCY HOIST SAVES WORK AND TIME

DURING AN EMERGENCY repair job I was short of labor and equipment. My problem was to lift a deepwell pump from a depth of 870 ft. The pump had accidentally become detached and fallen to the bottom of an 8-in. water well, which served a large dairy.

Equipment shown had seen better days, and been discarded. But it proved just right for this job. The hoist is the old-style handcrank type, commonly used on erection work. She's geared to lift 4500 lb. It would take two men six hours to wind up 870 ft of cable with the heavy pump attached. This would have been a back-breaking job, to say the least.

It was at this point we made a search to see if we couldn't speed things up.

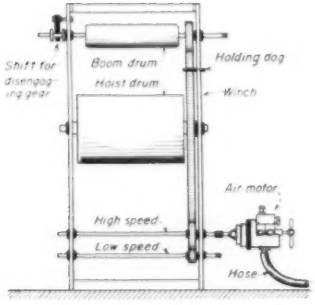
Here is where the old pipe machine electric "mule" was put to work. The square turning chuck of the shaft fits over the square end of the hoist shaft. The extension-cord connection for the motor was plugged in and the mule did the work of turning the hoist for 87 min. That lifted the pump to the surface at 10 ft per min.

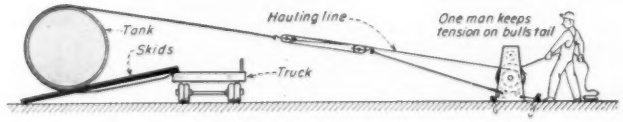
The most important gimmick was the "fishing" tool tied to the end of the cable. It was lowered into the well and successfully caught the extended shaft of the pump. The electric mule did the rest, using electric juice instead of hay and backache.

This equipment paid for itself again by doing this one job for us.

W R PENDER *New Orleans, La.*

PORTABLE AIR-MOTOR HELPS LOAD HEAVY TANKS





I WAS WITH A FIRM that manufactured welded cylindrical tanks for underground storage of gasoline and fuel oil. Tanks were made in standard stock sizes from 550 to 5000 gal. Also intermediate sizes of 1000, 1100, 1500, 2000, 3000 gal. The stock tanks were loaded by the stiff-leg derricks on trucks. Then hauled to a storage yard for reloading and shipping on order.

We had to move tanks from old storage yard to a new one. This problem was solved quickly and efficiently by hand winch, driven by air motor. Also with a rope block and falls, and skids from ground to truck body, see sketch.

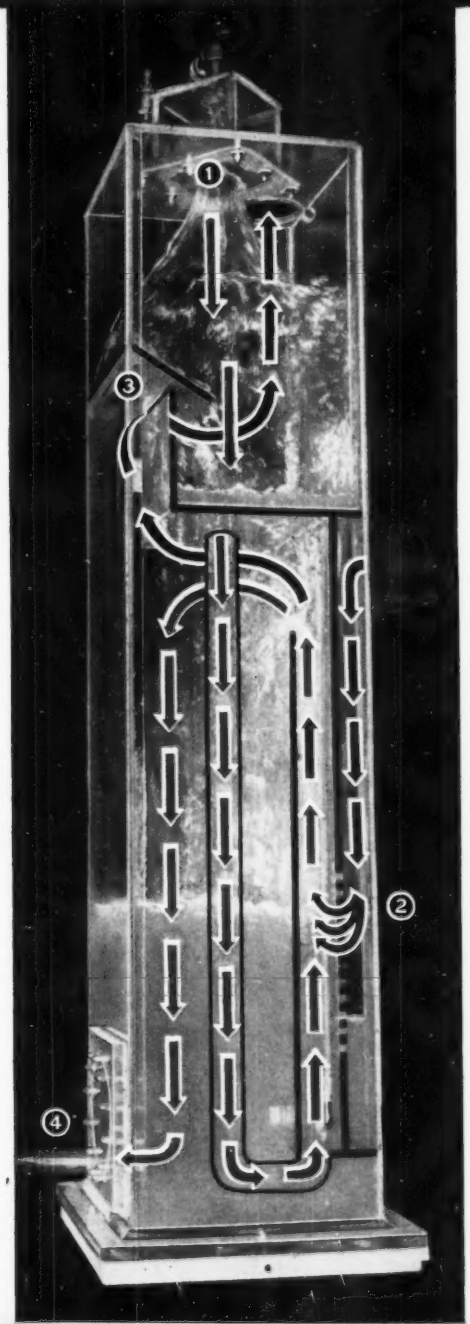
Tanks were unloaded by rolling them down skids. A rope was placed around tank and fastened to truck body for a brake. An air motor ran the winch, both for loading and unloading.

At the plant's rear end, railroad cars of steel flat plates, sheets, structural material, etc, were unloaded by a swinging boom attached to the structural-steel building. Motor power for this was also an air motor. This winch and air motor can be very handy around a plant.

A L SHEA
Springfield Gardens, N. Y.

(*Continued on page 140*)

ONE LOOK IS WORTH 1,000 GUESSES . . .



See for Yourself How the

PERMUTIT DEAERATOR

Removes All Oxygen and CO_2

This transparent model of Permutit's Deaerating Heater is a perfect picture of the operating ease and efficiency of the real unit it represents. Here are a few of the reasons why many engineers call it the best equipment for deaerating boiler-feed make-up water:

The Permutit Deaerator recovers waste heat economically, prevents corrosion of feed lines, stage heaters, economizers, and boilers, and is itself corrosion-free. It operates noiselessly and is adaptable to varying steam pressures. Above all, its simplicity of design insures a minimum of expense and attention for maintenance.

Write for full details to The Permutit Company, Dept. ME-9, 330 West 42nd Street, New York 18, N. Y., or to the Permutit Company of Canada, Ltd., 6975 Jeanne Mance Street, Montreal.

1. FIRST STAGE. Cold water, entering here, is heated almost to steam temperature by *spraying* it through steam. This removes 95% of the oxygen. The water then travels downward through the pipe toward the second stage.

2. SECOND STAGE. Here the partially deaerated water is intimately mixed with steam entering through the scrubber. Violent boiling and vigorous scrubbing is assured for both light and heavy loads, and deaeration is completed.

3. The steam from the scrubber travels upward and enters the first stage of the heater, where it partially deaerates incoming water. The remaining steam is then vented to the atmosphere.

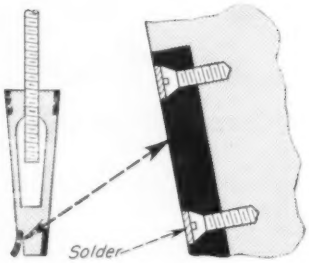
4. Here the completely deaerated water settles and may be drawn off. Ample water storage space is provided below the water control level.

Water Conditioning Headquarters for 40 Years

PERMUTIT

More PRACTICAL IDEAS

Begins on page 136



Screws and Solder Repair Gate Valves

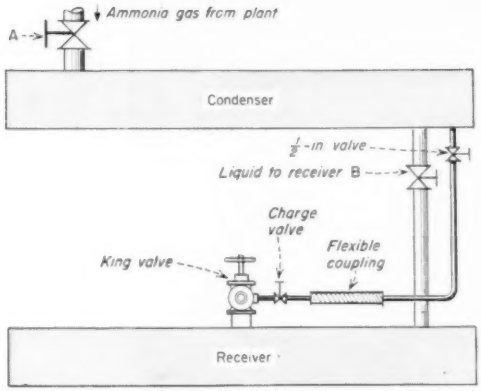
SEVERAL TIMES I have had the bronze faces come off the wedges of large cast-iron gate valves. To repair these, I take the bonnet and wedge from the valve body and press the bronze faces into place with C-clamps.

To hold the faces on the wedges I drill holes through the faces and into the wedges. Holes in the wedges are tapped for bronze screws, while in the faces they are countersunk.

I then tightly thread bronze screws in the holes against face and peen them into the countersinks. All holes or dents in the bronze faces are then filled with solder, filed and scraped smooth. This repair has always cured the trouble.

Solder is safe where temperature is below melting point of solder.

SAM BERGSTROM *Kingsford, Mich.*



SALVAGE TRAPPED AMMONIA IN CONDENSER

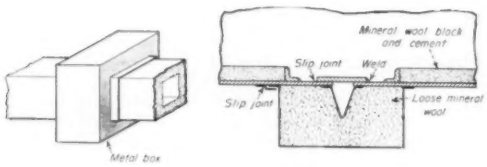
IN A BATTERY of five condensers, one developed a leaking tube. Because it was midsummer, with plant running well above capacity, it was next to impossible to pump down plant so we could cut out and replace leaky tube. Here's what we did:

To ½-in. valve on end of condenser, we made up connection as in sketch. This line runs into king valve above its disk when this valve is closed. Condenser was then cut out by closing valves *A* and *B*.

Allowing cooling water to circulate a few minutes to condense ammonia in condenser, we closed water valves. Then we closed king valve, and opened charge valve and ½ in. valve on condenser. Liquid ammonia was immediately drawn from condenser above closed king-valve disk into system as when charging system from ammonia container.

Charge valve and condenser valves were closed, king valve opened, and plant was back in operation shortly with no drastic change in evaporator temperatures. When heads were pulled off condenser, only a small amount of gas was left. This trick did the job.

D J PARMER *Quincy, Fla.*



DON'T FORGET EXPANSION JOINTS

WHO SAID insulating duct-expansion joints doesn't pay?

Calculations, made by insulation engineers of Public Service Electric and Gas Co, N. J., show that expansion joints of ducting should be insulated. Otherwise, surrounding areas are overheated and Btu's wasted.

To prevent heat loss at these vulnerable points, Public Service has hit upon a simple technique in its new 300,000-kw Sewaren plant.

They place a light-gage metal box over the joint as shown. One edge of box is not secured firmly, allowing it to slide as the joint contacts or expands. Box is filled with loose mineral wool to prevent heat loss. Depth of box depends on duct's temperature.

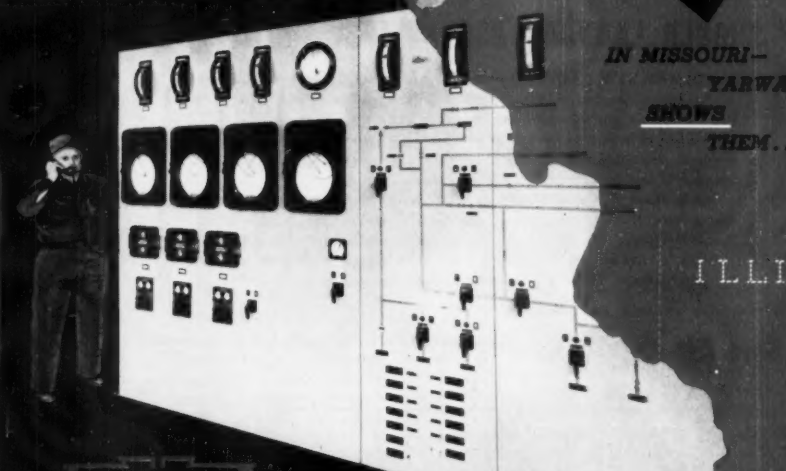
Public Service insulates its ducts both inside and out, depending on duct service. But expansion-joint covering is always used. The sectional drawing shows the joint-enclosure as applied to a duct insulated inside with mineral-wool blocks.

Regardless of expansion joint design, there is a way to insulate it.

R R MCCALL *New York, N. Y.*

The Empire District Electric Company orders and reorders...

IN MISSOURI— YARWAY SHOWS THEM...



Seven Yarway Remote Liquid Level Indicators on instrument panel at Riverton plant of The Empire District Electric Company. Each is equipped with control unit and remote Hi-Lo Alarms.

YARWAY

remote liquid level indicators

In Missouri
(as the saying goes)
you've got to show them your product is good.

Apparently The Empire District Electric Company at Joplin was shown. Not only are they satisfied with 8 Yarway Remote Liquid Level Indicators at the Riverton plant, they also plan to use 8 others in a new installation.

Yarway Remote Liquid Level Indicators bring readings down to convenient eye level. Accuracy is assured because the indicator is operated by the liquid itself . . . by the pressure differential between a constant head and the varying head in the drum or tank. Indicating mechanism is never under pressure. There are no stuffing boxes.

New control unit permits operation of additional Hi-Lo Alarms (light or horn) at any remote locations.

See Yarway Indicator Bulletin No. WG-1823 or Bulletin No. WG-1830 for the Yarway Indicator-Recorder.

YARWAY SERVICE GOES ALL THE WAY...

YARNALL-WARING COMPANY
100 Mermaid Ave., Philadelphia 18, Pa.
Branch Offices in Principal Cities

PLANT PROBLEMS... *put your know-how to work*

SHOULD LAUNDRY USE PUMPED RETURNS?

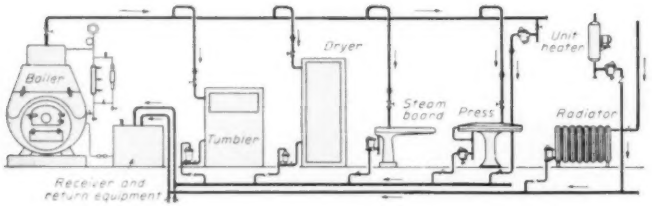
HERE ARE THE FACTS: Our laundry has several flatwork ironers of the steam-chest type. Steam line to laundry has a safety set at 100 psi. When we get 90 to 95 psi in ironer chests, valve pops.

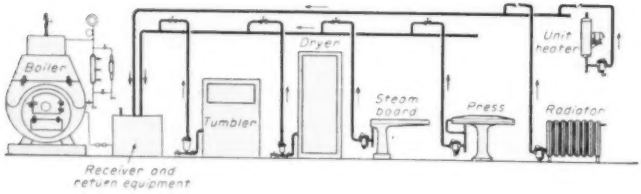
We asked boiler inspector to set valve higher than 100 psi but he refused. We think ironers work better at a pressure above 95 psi and wonder if we're getting best efficiency now.

Each chest has a bucket trap that works well. A friend thinks our return lines or traps may not be big enough to handle load. Another friend tells me we need a return system fitted with a pump.

What's best way of doing this job? Will bigger traps give us better production? Or is a condensate-return system better?—*EF*

Here Are the Answers





DON'T TOUCH safety valve. Have inspector check tension of spring to see that valve opens at right pressure. Heat may have reduced tension, allowing valve to pop at lower pressure. Or valve setting may be too low.

Loop system makes best feed for laundry units using steam. Try to change steam piping to use this layout.

Top sketch shows one way of piping a laundry that has return lines below the floor. Run piping as in lower sketch when return is above floor level.

Check condensate formed by all laundry units and see if traps are large enough. If not, increase their size. Do the same for return piping.

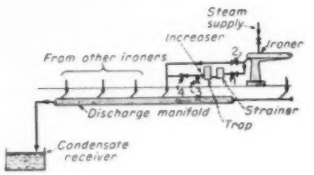
B D Riley *Brunswick, Ga.*

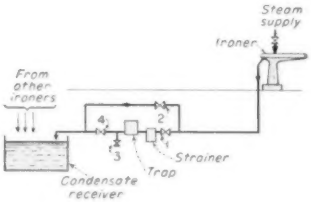
STRONG DRAFTS from open doors may be cooling chests. Or work may not be extracted properly before ironing. Check chest valleys for sagging in the middle. This causes rolls to ride on chest sides.

F R Fancett *Vancouver, B.C.*

THERMOSTATIC TRAP in steam line near ironer will stop air from reaching chests. Without trap, air accumulates at night while system is shut down.

J W Smithwick *Washington, D.C.*





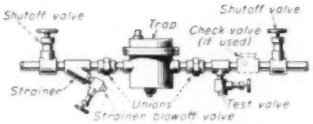
POOR DRAINAGE of condensate from ironer causes *EF's* trouble. Water backs into ironer, condenses steam in the chest.

Top sketch shows correct trap hookup for system with common return, lower for individual returns. Valves *1* and *4* isolate trap and strainer for maintenance; *2* is bypass, normally closed. Test trap with valve 3.

Increase trap outlet pipe size by two sizes and connect it to a 6- or 8-in. header. Large header prevents excessive pressure drop between trap and receiver.

Pressure drop is low with individual returns. Use them if there's enough room around ironers. If possible, keep trap within 18 in. of receiver.

A J Breugelmans *New York, N.Y.*

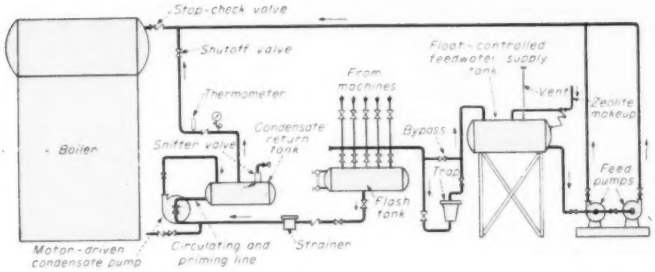


REPLACE OLD TRAPS with new and larger ones, piped as in sketch. Use test valve to find if return line is too small, if there's backpressure in line or scale that plugs pipe. All these will be shown by excessive amounts of water coming from test line. Put in a bigger return line if pressure loss is large and present line isn't plugged or doesn't have a partially closed valve. Install so condensate flows by gravity to hotwell.

Al Kelling *Parma, Ohio*

help the other guy cure his headaches

TYLER HICKS, *Associate Editor*



SKETCH SHOWS hookup that will get *EF's* machines hot and keep them that way. Condensate from machines enters the top of flash tank, leaves from bottom. Motor-driven condensate pump discharges water from flash tank into condensate-return tank. Snifter valve on tank allows air to escape to atmosphere.

From this tank condensate flows to boiler feed line where it joins water discharged by feed pump. Run one feed pump at a time when condensate return pump is running. Hookup reduces makeup, increases plant efficiency. The machines will stay hot.

M N GOZDENOVICH *Fairview, N.J.*

For your new problems from readers, turn to page 146

STEAM-PRESSURE rise and fall causes the trouble. Ironer inlet pressure must be 95 psi or higher if valve pops when gage reads 95 psi. I'm assuming *EF* has checked gage accuracy.

Safety valves are normally set 10 to 20 psi higher than pressure desired at ironer. If steam pressure at ironer is less than safety-valve setting, the valve won't pop even if traps and return lines are undersize.

Traps and pipes too small for condensate load cut ironer efficiency by not getting rid of condensate fast enough. If local code won't allow plant to run higher than 100 psi, *EF* should buy a good reducing valve and set it at 90 psi. Install on ironer inlet line.

ARTHUR S CASELLA
New York, N.Y.

SCALE on steam side of ironer throws heat transfer off. And air or gas in trap discharge lines cuts ironer production. Clean steam chests and put vents on the discharge side of ironers.

EF can try raising steam pressure but temperature rise will be only a few degrees and won't step up ironer efficiency too much.

CLYDE G HOWARTER *Canton, Ill.*

VENTED TANK for condensate is best. Fit with a float-controlled pump to return condensate to boiler. Test system before buying tank and pump.

HERBERT A KAISER *Glendale, N.Y.*

STEAM-LINE safety valve must be as close to ironer as possible. Run valve discharge line to a point where escaping steam won't injure anyone. Fit each steam chest with an impulse trap.

Installing safety valve as suggested gives maximum pressure in ironer. Separate trap insures maximum temperature in ironer and uniform distribution of heat. Be sure return line is large enough to handle discharge of all traps.

E F FERNES *Baltimore, Md.*

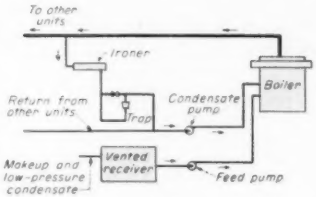
CHECK SAFETY-VALVE setting. If it won't hold pressure to a closer value than *EF* states, he should buy a new one. A good valve set at 100 psi won't pop at 95 psi.

With correctly adjusted safety valves, pressure should be easy to maintain. Traps should be right size to discharge all air and condensate. Use check valve between trap and return header.

SHELDON R HIGGINS
Long Beach, Calif.

AIR IN STEAM COILS is the trouble maker. It enters while ironer is shut down and there's a partial vacuum in the coils. Put a vent connection in ironer discharge ahead of trap. Globe valve in line will allow you to vent coil when ironer is started. Run line to roof or some other place where steam won't injure anyone. Instruct operator on correct use of valve before allowing ironer to be started.

A M PALMER *Brooklyn, N.Y.*



RETURN SYSTEM, for condensate pumps direct to boiler, cuts heat loss by 10%. See sketch for hookup.

For best results keep ironer chests full of dry steam. Don't let air enter because it cuts heat transfer.

Check main header with pressure gage to see that ironers have right pressure at full load. Ironers at end of line may run with lower pressure than those close to boiler. Traps may short-circuit when condensate backs up in return header.

Play safe and use air eliminators on laundry traps. Check bypasses often to be sure they're tight. If possible, install traps below ironers they serve.

L W FITZPATRICK
Jefferson City, Mo.

FRIENDS ARE WRONG; their advice is costly solution to problem. What *EF* really needs at his ironers is more heat. First check simple items. Be sure pipes are well insulated and return lines connected so condensate runs out easily. Use bypasses on traps. Be sure there is no backpressure in return line.

JOHN P MULVEY *Yonkers, N.Y.*

MORE AND SMALLER traps may be *EF's* answer instead of bigger ones and condensate pumps. Some time ago I took over a dry-cleaning plant and ran into some big headaches. Every morning it was the same story—wet pads and lukewarm presses. All returns were piped to one large trap.

I pulled out the big trap and put a ½-in. trap on each press. Large trap drains steam line just ahead of presses. Presto—my troubles disappeared.

Check supply and return-line size and pitch. Many laundries keep adding equipment from year to year without ever thinking of line size. Put a trap on steam line ahead of presses so any condensate in line will be drained. Try to keep all ironer traps below units drained. This steps up output.

ART CANNON
Laurence Harbor, N.J.

(*Continued on page* 144)

More PLANT PROBLEMS

Begins on page 142

CHECK TRAP SIZE first. Flatwork ironer with 100- to 120-in. chest has a load of about 480 lb per hr. If traps are too small, put in larger ones. See that return lines are laid out so there's a minimum of flashing. Flash tank that vents to heating mains or other low-pressure units does good job. Or pass flash to a heat exchanger to heat incoming cold water. Some laundries have large heat exchangers to reclaim heat from waste wash water.

Four points to check are: (1) See that air is promptly and efficiently eliminated from rolls. (2) Look for possible steam binding of siphon loop from roller to trap. (3) Check moisture in steam entering ironer. (4) Look for excessive pressure drop in steam-supply line.

P Williams *Somerville, Mass.*

LOW PRESSURE, 90 to 95 psi, cuts ironer output. Check with manufacturer. *EF* will find that a pressure of not less than 100 psi is needed. We use 110 to 115.

Use individual traps on each ironer for best results. Return line should be at least 2 in. Be sure return line discharges to a vented condensate tank.

Check roll pressure to see that linen has enough tension as it passes from roll to roll. Tension keeps linen flat on chests. Also check apron tension. It must be enough to keep linen in contact with chest's under side.

J F Rivers *Atlanta, Ga.*

A PAT ON THE BACK for the boiler inspector—he deserves it. Most flatwork ironers are made to withstand only 100 psi. Also, I think *EF* is looking for trouble on the wrong side of his machines.

If system was OK at first, trouble may be from another load on supply line, plugging of the line, or a partially closed valve.

You get full efficiency from a flatwork ironer when it runs as fast as work from it can be handled. For other hints look over Power's trap article (Feb. 1952, on pages 112 and 113).

W O Tatman
Ramey AF Base, Puerto Rico

TEST TRAPS to learn if they keep steam chests dry and air free. Perhaps *EF* hasn't checked ironer capacity. He may be running at maximum output now. If so, he'll need more units to handle his load. Superheated steam may work in ironer, but don't use it until after you've made some tests to see if it is OK for the cloth you are handling.

James P Demas Sr.
Roselle Park, N.J.

NEW HEADER of larger size or an auxiliary header to help present one is needed. Check flat work to see it is properly extracted. This is important.

Frank Fenger *Omaha, Neb.*

VACUUM-RETURN SYSTEM is better than complete repiping of plant. This decreases system backpressure. Some traps may have to be changed, but the scheme is less expensive than complete repiping. It would also overcome the inspector's objection to 100-psi steam in the ironers.

M N Collison *Flin Flon, Canada*

PRODUCTION INCREASE is easy to get with steam that is a few degrees hotter. Having maximum temperature possible is important.

Trouble cause is pressure drop in steam line between relief valve and ironer. Check gages and relief valves to see they give right reading and pop pressure.

Try using a larger pipe to ironer. This will reduce pressure drop and may step up output. Check present pipe and valves to see there are no obstructions. Scale can give much trouble.

Roy M Stinson *Des Moines, Iowa*

MORE GOOD ANSWERS

Other readers who submitted good answers to this question are:
Matt Jones, *Dallas, Tex.*
A M Leader, *Warwick, R.I.*
William S Silson, *Medfield, Mass.*
Arthur J Wenig, *Brooklyn, N.Y.*
George G Avant, *Wilmington, N.C.*
Sorry there wasn't space for them.

For your two new problems from Power readers, turn to page 146

WHAT TURNS COOLING-TOWER WATER RED?

HERE ARE THE FACTS: We have an induced-draft redwood-filled cooling tower serving gas engines in our pumping station. Tower filling is nail-less with little exposed metal in water path.

Shortly after tower went into operation, cooling-water color changed to dark red. We emptied system and refilled it with city water, but after a few days the water turned dark red again.

We haven't started to treat our water yet but we've been wondering if the color change means treatment is needed. What makes it turn red? Should we drain red water? What's best treatment?—*CJ*

Here Are the Answers

IT'S TANNIN. Woods are basically and structurally the same, but each variety contains certain materials within the cells that impart distinctive properties. These materials are responsible for the color of the wood and also provide the fungicidal properties that resist decay.

When a redwood cooling tower is first put into service, circulating water dissolves the most soluble of these materials. Discoloration comes from tannins in the wood. Wood durability is not reduced appreciably. High alkalinity accelerates leaching and may lower durability if pH control isn't provided. Feed sulfuric acid to keep pH between 6.5 and 7.5.

Water discoloration is undesirable in applications where water contacts manufactured products, as in the paper industry. Reduce discoloration by using some oxidizing agent like chlorine. Without such an agent discoloration will disappear in a few months.

Tannin is a surface-active agent that prevents scale formation. Its presence in most circulating systems is actually beneficial from standpoint of scale.

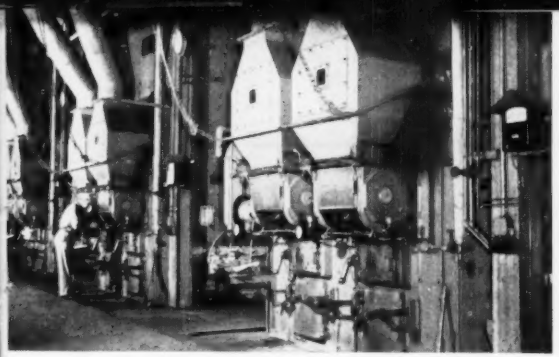
D R Baker *The Marley Co, Inc Kansas City, Mo.*

OIL ON SLATS, put there to make them water repellent and less brittle, causes discoloration. It is harmless and will disappear completely after a while.

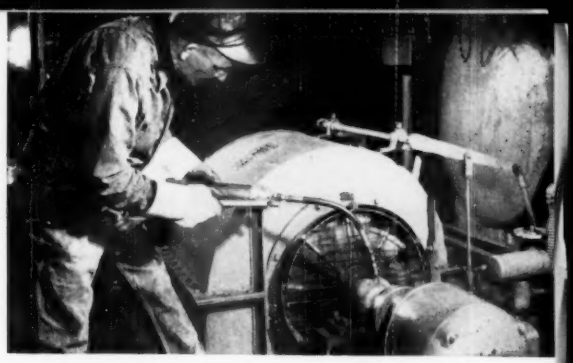
John P Mulvey *Yonkers, N.Y.*

IRON OXIDE causes the red color. Sodium-hexametaphosphate treatment ends red water. It also prevents scale formation. Pour into tower basin and check daily with phosphate comparator.

Manually blow down tower an amount



TO GENERATE STEAM for manufacturing, Triangle Conduit and Cable uses three 350 hp boilers. Each unit generates 22,500 pounds per hour, 24 hours a day, 5 days a week. *Sun Solnus Oil* lubricates the spreader stoker oil bath, *Sun 844 Grease* the pulley drive, stoker motor and pillow block.



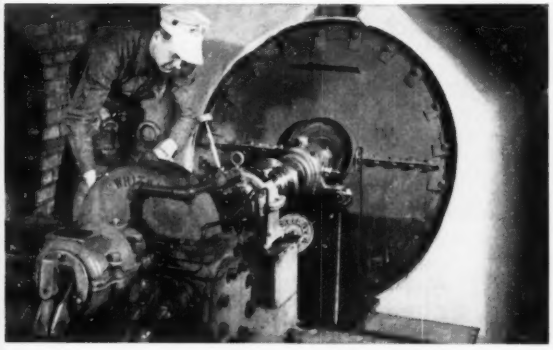
TO CONTROL THE AMOUNT OF AIR entering the fire box, three forced draft fans are kept in constant operation. The motor and fan bearings and the speed reducer motor are lubricated with *Sun 844 Grease*, while the gears and reducers are protected by a *Sun* gear oil.

MODERN POWERHOUSE ENTIRELY SUN-LUBRICATED

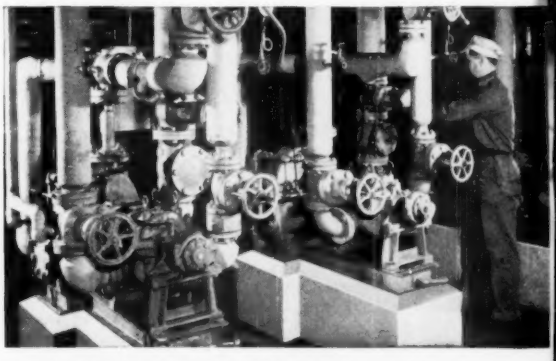
Triangle Conduit and Cable produces flexible and rigid electrical conduit and cable. Its modern powerhouse generates steam for galvanizing pipe and for heating the factory, the pickling vats and the enamel paint vats prior to dipping the pipes. From the very beginning of operations more than two years ago, Sun oils and greases have been used exclusively in all the equipment, and there hasn't been a single failure because of faulty lubrication.

This modern powerhouse is wholly lubricated by Sun "Job Proved" products and the factory partly so. In both, Sun's engineering know-how has effected purchasing and inventory economies through multiple use of a minimum number of oils and greases.

For technical assistance or a copy of the manual "Lubrication of Industrial Machinery," write on your business letterhead to Department **P-1.**



TO HELP GET PROPER COMBUSTION in the boilers, three exhaust fans are used. The turbine which drives them turns up 3,600 rpm. The engineer says the lubricant, *Sunvis 951*, looks like new when it is changed to get rid of condensate.



TO FEED WATER TO THE BOILERS, two 3,500 rpm turbine-driven pumps are employed. A motor-driven pump is used in starting up when there is no steam pressure. *Sunvis 951* lubricates the turbines, *Sun 844 Grease* the pump fittings.

SUN INDUSTRIAL PRODUCTS

SUN OIL COMPANY, PHILADELPHIA 3, PA. • SUN OIL COMPANY, LTD., TORONTO AND MONTREAL

SUNOCO

More PLANT PROBLEMS

Begins on page 142

equal to the water lost by evaporation. This is easiest way to remove solids.

Chlorine powders are safest for algae control. Keep tower enclosed as much as possible to exclude light, which helps algae grow more rapidly.

L W FITZPATRICK
Jefferson City, Mo.

RAIN WATER is good for towers, especially if local water supply is unsuitable. Don't use any water treatment without getting an OK from tower manufacturer. My experience as a refrigeration repair man shows that all tower water is discolored. If system works right, think nothing of discoloration.

A M PALMER *Brooklyn, N.Y.*

TOWER BASIN may have to be drained every two weeks or once a month to remove sediment. This depends on local air conditions.

M N COLLISON *Flin Flon, Canada*

DRAIN SMALL TOWER several times to reduce color intensity. In a large tower this is expensive, so let color become diluted by normal operation. Strong color fades to a faint amber after about three months.

Color has nothing to do with need for water treatment. In some towers tannic acid leached from the wood will control algae for the first few months, after which treatment is needed. Bromine, fed as shock treatment, or chlorine controls algae. Feed chemicals automatically or manually to tower basin.

Test water to see if color is from rust.

L J WEIDNER JR
S. Pasadena, Calif.

Other readers who submitted similar answers are:

HOWARD T LIVINGSTON, *Los Angeles, Calif.*
CLYDE G HOWARTER, *Canton, Ill.*
HENRY A ULRICH, *Los Angeles, Calif.*
A J BREUGELMANS, *New York, N.Y.*
A M LEADER, *Warwick, R.I.*
J TORREANO, *Calumet, Mich.*
ARTHUR BELTON, *Montreal, Canada*
MARTIN N GOZDENOVICH, *Fairview, N.J.*
A M DAMEROW, *Elk River, Minn.*

Sorry we didn't have space for them.

CERTAIN OILS and other constituents of redwood are leached from the wood during initial tower operation. These color the water. Leaching is usually complete after one to two months of service. If water is dumped then and system refilled, the dark red color disappears.

Consult water-treatment specialist for right method. Water treatment, needed for most towers, should begin at once. It's important to prevent scaling of gas-engine jackets, piping and valves.

H R BAKER JR
C H Wheeler Mfg Co, Philadelphia

YOUR NEW PROBLEMS

1 What Makes Diesel Shift Its Loads?

Our diesel plant has two 300-kw units that run at 360 rpm, and one 700-kw unit that turns at 257 rpm. Recently our load increased considerably so we now buy current from the utility and run the diesels in parallel with it.

When we run the 700-kw unit in parallel with utility lines there is a continuous load shift between engine and line of about 80 kw. Pulsations are at a rate of about 120 per minute. This is enough to cause trouble on TV and X-ray machines.

We tried a new governor and changed setting of both the new and old ones but couldn't stop load shift.

What causes this trouble? How can we stop it? Why does it happen only to 700-kw unit?—*CM*

2 How Can I Cut Plant Vibration?

Our power plant serves an industrial plant having a number of hammers, grinders and machine tools. Powerhouse has fans and refrigeration compressors besides boilers and turbines. On roof of manufacturing plant we have a large cooling tower with motor-driven fans.

Our fans and refrigeration compressors have given us trouble ever since they were put in a year ago. Vibration of cooling-tower fans shakes the building. Piping connections to compressors were broken by vibration.

Have *Power* readers ever had problems like this they solved after equipment was installed? What's best way to stop vibration without extensive changes in machinery foundations and piping? We've thought of cork, rubber and spring isolators. Which is recommended?—*IK*

Will you help readers who sent us problems? Extra pay for photo or sketches.

CUTTING CREAMERY COSTS

(Another answer to the January 1952 question)

DON'T USE A HUNCH to solve an engineering problem involving money. And treat a salesman's diagnosis with care. Best bet is a consulting engineer familiar with creamery plants.

To help *GG* make a preliminary estimate I've set up a table of typical values. He can fill in the blanks, add the columns and read the answer. Figures in parentheses are estimates based on the limited information *GG* gave. Burn furnace oil, not diesel oil, under the boiler.

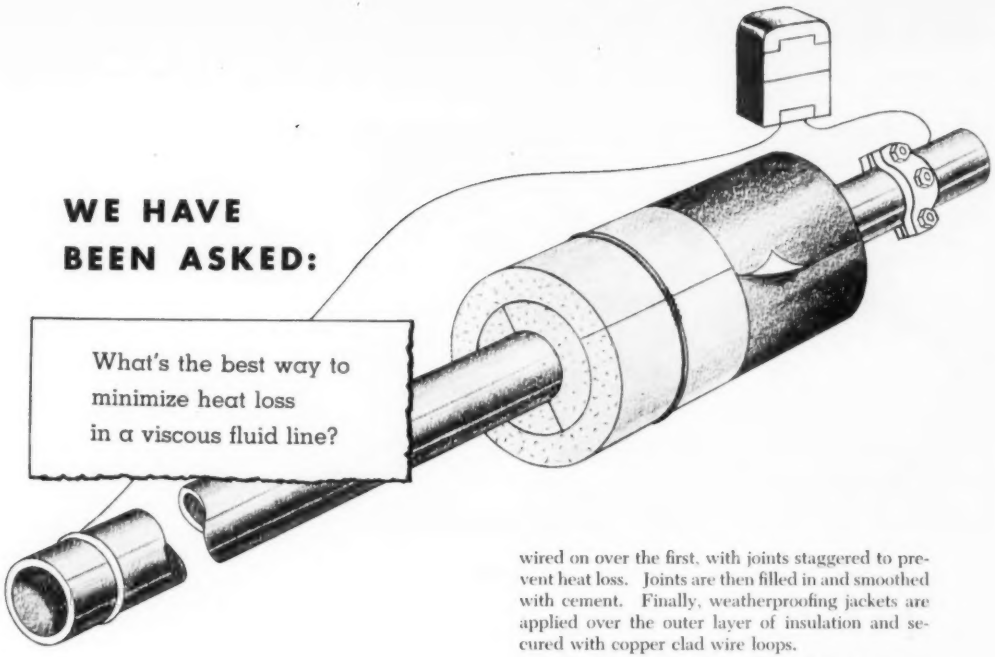
For present plant add these annual costs:	
Electricity: (12) × ($200) =	$2400 ($2400)
Coal: (12) × ($100) =	1200 (1200)
Fireman's wages	— (2000)
1. Total annual cost, present plant =	($5600)
For proposed plant:	
Interest rate investment will earn =	(0.06)
Equipment depreciation = 1 ÷ life in years. With 15-yr-life depreciation =	(0.07)
Taxes, insurance, maintenance =	(0.05)
Total fixed charge =	(0.18)
To find annual costs for proposed plant add:	
Diesel-generator first cost × fixed charge = ($4500 × 0.18) =	($ 810)
Fuel cost = total kwhr per yr × oil price, per gal / 11 = (85,000 × 0.15 ÷ 11) =	(1160)
Operator's wages =	(500)
Burner cost × fixed charge = ($1500 × 0.18) =	(270)
Fuel cost = present coal bill × 14 × 13¢ per gal for fuel oil = ($1200 × 14 × 0.13) = (This assumes 50% boiler efficiency on coal, 60% on oil, 12,000 Btu per lb coal at $10 per ton, 140,000 Btu per gal of fuel oil.)	(2190)
Fireman's wages =	(500)
2. Total annual cost for proposed plant =	($5430)

If (2) is less than (1), as it is in this assumed example, *GG* should consider the change.

Based on the estimate in parentheses, proposed plant would pay for itself in less than 15 years. But remember, all I know about *GG*'s plant I had to learn from his three short paragraphs. His location will affect fuel cost. This is a big item in any power-cost study.

As I said, he should get a consulting engineer. Have him show how he gets his figures. There's no mystery about estimates. And there's no short-cut. To do a sound job it takes a lot of figures, few guesses. There's no other way.

E S FERGUSON *Ames, Iowa*



We recently received a letter which posed this problem:—"How should we insulate a 3" outdoor pipe line which carries asphalt approximately one thousand feet from a storage tank to the processing operation? The asphalt leaves the heated tank in a fluid state at 450° F. and must be kept above 435° F. to insure proper flow."

With this great length of pipe, insulation alone cannot be expected to hold the temperature above the 435° minimum. Should occasional shutdowns occur, no practical amount of insulation will prevent the asphalt from solidifying in the line, particularly in cold weather. Some method of applying heat to the pipe such as charging it with low voltage electricity or using a steam tracer line is recommended. This will keep the pipe warm enough to maintain proper temperature and keep the asphalt fluid, regardless of interruptions in the flow. The line should then be insulated with Double Standard 85% Magnesia according to standard specifications.

The pipe covering is applied in two layers, the first being securely wired in place. The second layer is wired on over the first, with joints staggered to prevent heat loss. Joints are then filled in and smoothed with cement. Finally, weatherproofing jackets are applied over the outer layer of insulation and secured with copper clad wire loops.

85% Magnesia is ideally suited to this and a variety of other jobs for temperatures up to 600° F. It has proved its outstanding insulation efficiency and durability through years of trouble-free service. It offers great mechanical strength, will give top performance even under severe conditions. Yet it is lightweight, easy to apply, and completely fireproof.

Next time you're up against any insulation problem, contact your near-by Armstrong office. The technical advice of an Armstrong engineer is always available to you with no obligation. The Armstrong organization can take over the entire job for you—furnish the correct materials for your particular job and the skilled workmen to apply them properly. Our complete insulation service can save you time, trouble, and money—and you'll be **sure** of having a thoroughly professional job!

SEND US YOUR QUESTIONS. If you have any question on insulating materials or their use in high-temperature installations, please write us. We'll see that you get a prompt, practical answer. Just address your letter or post card to Armstrong Cork Company, 7005 Maple Avenue, Lancaster, Pennsylvania.

ARMSTRONG'S INDUSTRIAL INSULATIONS

MATERIALS - INSTALLATION

FOR ALL TEMPERATURES FROM 300°F. BELOW ZERO TO 2800°F.

ARGUMENTS

Here's the place to unload your gripes to editors, manufacturers and fellow engineers

ALL FIRED UP OVER SOMETHING

EARLY ONE MONDAY MORNING a few months back I was taking a countryside drive in search of a client. Suddenly, in a small mill town, I saw the fire truck pull out of its station. I'm a salesman for boiler-room safety devices so, thinking I might get some business, I tagged along. The fire truck pulled up in front of a middle-aged woolen mill, and the sight was something to behold. Live steam and men were pouring out of every window and door in the place. The firemen all dashed into the front door of the plant, so I decided to wander back to the boilerhouse, where the scent of a sale was strongest.

When I entered the boiler room, I found the fireman exhausted from shoveling coal. He had a roaring fire going under a pair of watertube boilers. And instead of popping the safety valves at 200 psi, he couldn't for the life of him get the pressure above 40 lb. It was too early in the morning for much of a load from the plant, yet 40 psi was the best he could do. Just then the fire chief walked in to report a 4-in. steam pipe was disconnected and the factory was filled with steam.

It turned out that pipe fitters had forgotten to close a stop valve during a week-end repair job and had left without making up the 4-in. piping. They had also neglected to leave word for the fireman, who started the boilers at 6 am the next day. The poor guy spent two hours filling the factory with steam.

STEVE SMITH *Canton, Mass.*

Vacation-Shutdown Woes

MANY FACTORIES have the practice of shutting down completely for a 2-week summer vacation and request the chief engineer to shut off the main water supply. Then when the plant's shut down and a fire breaks out, everyone wonders why the sprinkler system failed.

G K PAYNE *Dallas, Texas*

Here are three sides of Tom Dean's steam-trap dilemma—ED.

Should Use Orifice

TOM DEAN is correct in his stand to use orifice to drain superheat lines during warm-up (p 136, Jan '52, POWER). Air carried over from drum during warm-up causes condensate to turn to water-logged vapor or mist. Thus, actual free condensate is practically nil and steam trap won't work properly.

My suggestion is a 1-in. needle valve (acting as orifice) on boiler-drum top. Crack slightly before firing to exhaust trapped air as temperature goes up. Then use orifice in line.

L W FITZPATRICK *Jefferson City, Mo.*

No, He Should Use Trap

TOM DEAN should use trap. An orifice removes most of the condensate, but part of it is also broken up on impact with orifice and is carried along with steam.

Traps will remove more condensate than orifices. They are closed part of the time giving condensate time to form and then be positively blown down. Returns from trap can be saved while orifices cause wastage.

IVAN A KAYE *East Douglas, Mass.*

Upset Tubes or Ferrules?

COPPER, BLACK-IRON and even wrought-iron ferrules are in common use to bridge gap between tubes and enlarged tube sheet holes (p 112, May '51, POWER). Since ferrules are softer than tubes, shimming still stretches tubes to make tight fit. I say you don't have to use ferrules. You can get tubes with upset ends to fit enlarged holes to within 1/64 in. This cuts expansion in shimming and gives tubes more holding power at ends, plus cutting shim-time.

ELIJAH WILLIAMS *New Haven, Conn.*

For Safety's Sake

SAFETY IS a power man's best friend. Without it we'd all be in bandages and on crutches most of the time. Yet what do you do if a fellow has an accident despite safety precautions? What do you do if a guy is hurt by steam, electrical burns and shock? I'd like to see some pages in POWER on first aid in accidents, with a starter on the new method of artificial respiration.

BARNEY RILEY *Brunswick, Ga.*

Watch for a 2-pager on new artificial-respiration method in an early issue of POWER. *We've not forgotten safety.*—ED.

Use Manual Drains

ORIFICE CAN BE USED, but after heat-up no condensate remains and much steam is wasted from there on. Steam traps may be used, but after warm-up they act as steam condensers and more waste occurs.

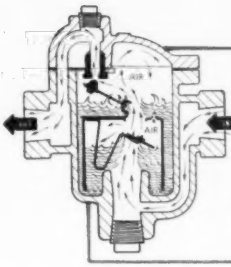
Local conditions, of course, determine the answer. But if lines are above 100-F superheat for more than a week at a time, I say drain during warm-up by manually operated drains. Water can be returned to system, and steam flow is smooth after superheat is reached. Investment cost also cut.

CHAS A SPENCE *London, Eng.*

ARMSTRONG "BLAST" TRAPS SPEED UP HEATING

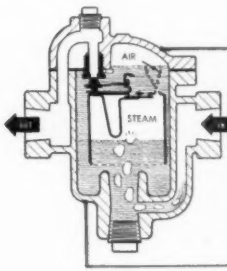
of Single Pipe Coils, On-and-Off Multiple Coils, Unit Heaters, etc.

AIR WHISTLES RIGHT THROUGH



VENT OPEN

Note large air bubbles "whistling" through large thermic-control vent to be discharged with condensate through open trap valve. Shaded grey area is condensate.



VENT CLOSED

After accumulated air and condensate are discharged, large vent closes. Small vent is always open to handle ordinary volume of air entering trap.

IN equipment where large amounts of air accumulate when the steam is turned off, and where the air can be pushed out ahead of the steam, Armstrong "Blast" Traps provide remarkably fast heat-up. A corrosion resistant invar and stainless bi-metal strip holds open a very large vent which lets air whistle right through the trap when equipment or lines are cold. As soon as steam reaches the trap, the bi-metal closes the big vent.

Armstrong Blast Traps combine the benefits of quick heat-up with the dependable service of mechanical traps. There is no bellows to leak or collapse due to high pressure. In fact, the traps are hydraulically tested at 500 lbs. pressure before they leave the factory.

Call your nearby Armstrong Representative for details and prices.

ARMSTRONG MACHINE WORKS

812 Maple Street • Three Rivers, Michigan

THE ARMSTRONG STEAM TRAP BOOK tells all about Armstrong Blast and Standard Traps—where to use them and how to select and install them. You are welcome to a copy. Just write for it.

SEE OUR CATALOG IN SWEET'S

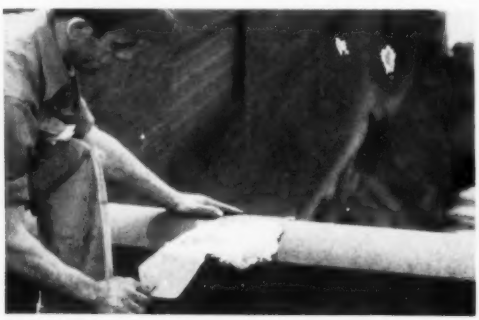
ARMSTRONG STEAM TRAPS

HOW TO HELP ROOF REFLECT SUN'S RAYS

ALUMINUM COATING is sprayed to throw off sun's rays. Spaces below roof are from 10 to 20 F cooler — roof lasts longer

1 Repair old roof surfaces by filling small breaks. Cut open, then fill blisters with aluminum roof cement. In same way, cut and fill larger holes, breaks or open seams. Place patch, with a second layer of cement over each patch, as shown here

2 Reinforce flashings and repair critical spots around skylights, chimneys and firewalls with patch, then cover with cement. Allow for expansion and contraction of patch from temperature changes by folding it vertically and horizontally



3 Fill any leaks or cracks in coping with aluminum roof cement. If needed, put on patches and cover with more cement. Also fill holes in minor gutter leaks, then add a second coating of cement. First idea is to have a sound roof

4 Brush or spray aluminum roof coating. If no spray equipment, brushing is practical for smaller roofs. Coating dries to form durable layer. Job does triple duty of reflecting the damaging sun rays, waterproofing and preserving roof

SPRING IS THE TIME to prevent scorching summer roofs. How? Protect with an aluminum roof coating. By reflecting sun rays instead of absorbing them as black surfaces do, aluminum coatings lower inside temp up to 20 F.

Roof surface is not only highly reflective; it is also attractive. A good grade of aluminum roof coating contains asphalt and asbestos to form a pliable, waterproof layer. This protects from harmful drying sun rays and preserves roofs for years. This information is from the Paramount Industrial Products Company, Cleveland, Ohio.

There's a Powell Valve ...FOR EVERY POWER PLANT REQUIREMENT

The complete Powell Line for Power Plants—Gate, Globe, Angle, Check and Non-return Valves in all required sizes—are made for the following working steam pressures: Bronze, 125 to 350 pounds, inclusive; Iron, 125 and 250 pounds; Cast Steel, 150 to 2500 pounds, inclusive.

In Cast Steel, Powell not only makes bolted bonnet valves of all types but also outstanding lines of Pressure Seal and Integral Bonnet Valves.

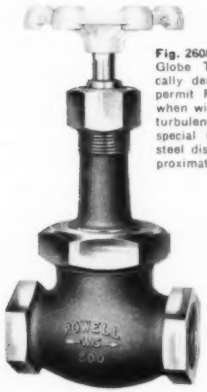


Fig. 2608—A new 200-pound Bronze Globe Throttling Valve. Scientifically designed and proportioned to permit FULL FLOW through seat when wide open, greatly minimizing turbulence and pressure drop. Has special bronze stem and stainless steel disc and seat hardened to approximately 500 Brinell.

Fig. 375—200 pound Bronze Gate Valve. Screwed ends, inside screw rising stem, union bonnet and renewable wear-resisting "Powellium" nickel-bronze disc.

Fig. 1333-A—Steel Integral Bonnet Angle Valve for 1500 pounds W.P. Socket weld ends. Sizes ½" to 2", incl.

DEPENDABLE VALVES SINCE 1846

Fig. 1503 W.E.—150-pound Cast Steel Gate Valve with welding ends, outside screw rising stem, bolted flanged yoke, tapered solid wedge.

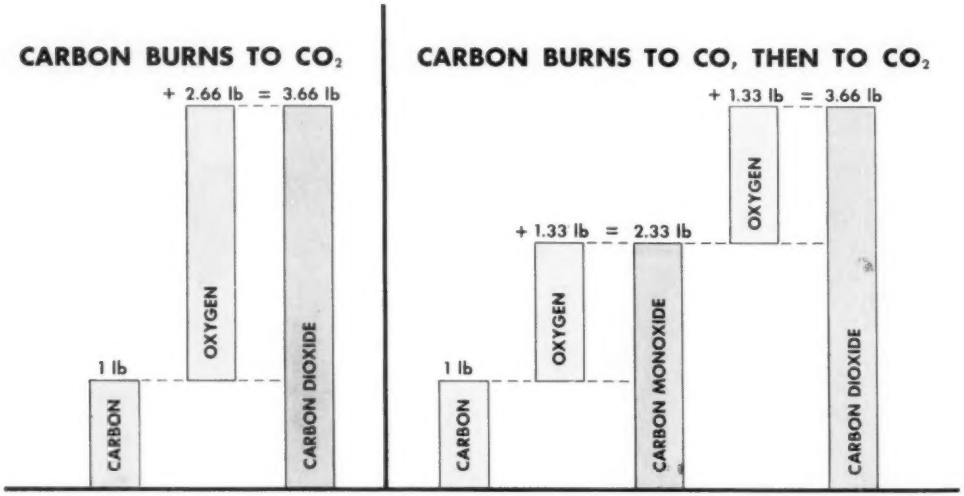
Fig. 1314-A—1500-pound Steel Integral Bonnet "Y" Valve with socket weld ends. Sizes ½" to 2", incl.

POWELL VALVES

The WM. POWELL CO., 2525 Spring Grove Ave., P. O. Box 106, Station B, Cincinnati 22, Ohio

HEADWORK

PHIL SWAIN BRINGS ENGINEERING THEORY DOWN TO EARTH



How Carbon Burns

► IN AN AVERAGE bituminous coal more than 80% of the total heating value is in the carbon contained. Even boiler oil averages about 85% carbon by weight, although the hydrogen contained does represent about 40% of the oil's heat value. That's why learning how carbon burns is the first and most important step in understanding combustion.

When carbon burns it merely combines chemically with oxygen in the air. Air is 23% oxygen by weight and 21% by volume.

Normally (complete combustion) one atom of carbon combines with two atoms of oxygen to make one molecule of carbon dioxide. Here is the reaction:

$$C + 2O = CO_2$$

Here CO_2 stands for a molecule that contains 1 atom of carbon (C), and 2 atoms of oxygen (O).

Using the formula and the atomic weights, it's easy to figure how much oxygen will burn one pound of carbon to CO_2. The atomic weight of carbon (that is, the weight of its atom compared with an atom of hydrogen, the lightest atom) is 12. Atomic weight of oxygen is 16. So we have, in terms of parts by weight:

12 parts C + 32 parts O = 44 parts CO_2

If we divide everything by 12 we get:

1 lb C + 2.66 lb O = 3.66 lb CO_2

Sometimes (with air short) some of the carbon burns incompletely to carbon monoxide (CO). Then chemists write the reaction as shown here:

$$C + O = CO$$

Thus 12 parts C + 16 parts O = 28 parts CO.

Divided by 12 we get the following:

1 lb C + 1.33 lb O = 2.33 lb CO

To burn this 2.33 lb of CO to CO_2 takes another 1.33 lb of oxygen and gives 3.66 lb of CO_2.

Note that burning one pound of carbon to CO_2 requires exactly 2.66 lb oxygen and gives 3.66 lb of CO_2. This relationship holds true whether conversion occurs in one step or in two.

No "Cover" Charge Here!

THE INDUCED-DRAFT FAN MOTORS look pretty small right out in the open air at the base of the towering stacks. But with today's building costs there would have been nothing small about the "cover" charge for brick and mortar walls and a steel-braced roof to house the motors.

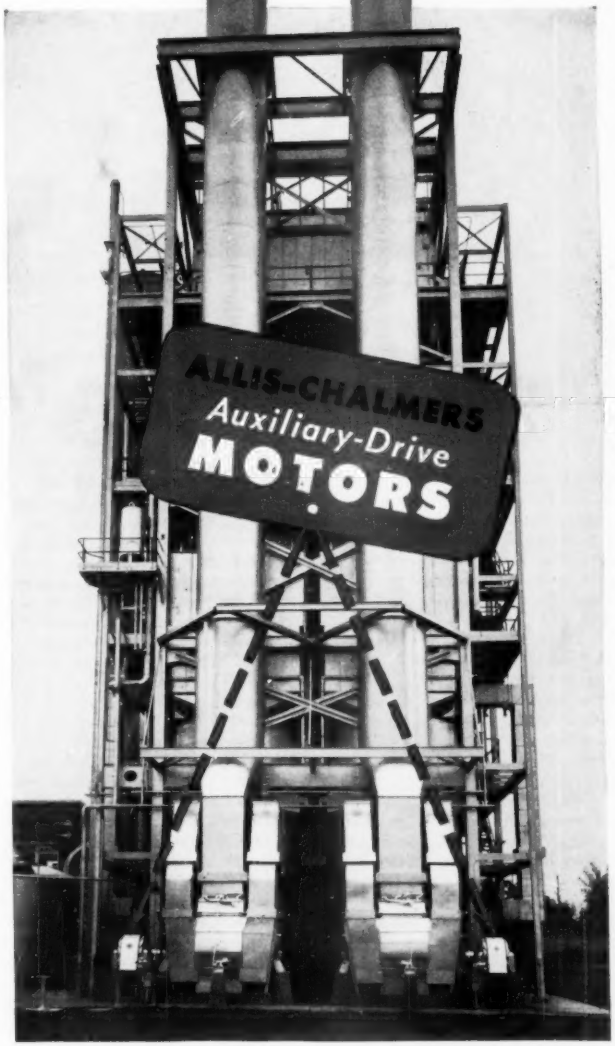
Fortunately, modern Allis-Chalmers auxiliary-drive motors need no costly enclosures.

You can count on Allis-Chalmers motors for the kind of operation you need for continuous power generation . . . because A-C has the experience essential to designing and building motors for outdoor use.

For many years, A-C has been supplying splash-proof motors for a variety of outdoor applications. Since 1946, *tube-type* totally-enclosed fan-cooled motors have been available for operation under the most severe conditions indoors or out. And Allis-Chalmers is now offering *weather-protected* motors especially developed for modern outdoor power plants.

Talk Over Your Needs

All three types are available in sizes and speeds to meet all major auxiliary-drive requirements. Your nearby A-C representative can help you select the motors that will best fit your needs for money-saving outdoor installations. Allis-Chalmers, Milwaukee 1, Wis.

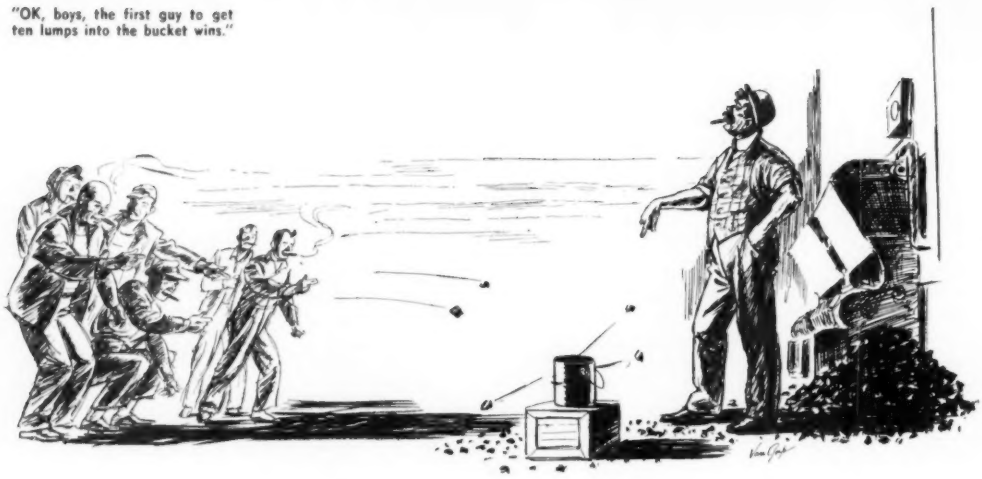


Two 450-hp, 695-rpm, splash-proof cage motors driving induced-draft fans — as well as other Allis-Chalmers auxiliary-drive motors — are installed outdoors at the Natchez Steam Electric Station of the Mississippi Power and Light Company.

A-3653

ALLIS-CHALMERS

"OK, boys, the first guy to get ten lumps into the bucket wins."



Marmy's Evaporation Test

"We're all happy in this plant that Marmaduke Surfaceblow is now a consulting engineer. But who consults him besides his old shipmates at the Bent Propeller Bar? In other words, how does he make his money to pay the office rent? We'd all like to know."

► LETTERS LIKE THIS have been coming in daily. By golly, I thought, after reading this one over again, why not tag after Marmaduke and watch him in action. That may help me answer a lot of questions. I reached for his business card. Then I dialed Hells Kitchen 2-1876.

"WHAT D'YA WANT?" roared a familiar foghorn voice from the other end.

"This is Steve Elonka on POWER," I answered quietly, moving the receiver about a foot from my head before an ear drum let go.

"How about going out on one of your jobs? I'd like to soak up some first-hand information on the consulting business."

No answer. Then a noise like a tight cork being twisted out of a bottle. Then — gurgle — gurgle — "I'LL BE AT THE TITLEBAUM TANNERY IN HOBOKEN, NEW JERSEY, TOMORROW MORNING" — gurgle —gurgle. B-A-N-G!, went the receiver.

That's interesting, I thought, after my ear stopped ringing. Here's where I see the old boy do his stuff. Wonder what kind of a problem he has at the tannery.

But the next morning I got tied up at the office and couldn't find time to leave. The second morning I had more of the same. At noon I did sneak over to Bedlam's Bent Propeller Bar for a snack—and for some inside information.

"Look here, Bedlam," I said, addressing Marmaduke's old shipmate. "I was supposed to be at the tannery in Hoboken with Marmaduke yesterday, but couldn't get away. How long will he be there and what's going on?"

Bedlam blew the suds off four glasses of beer, with one mighty puff, then drawled, "Marmy was in here last night and he's got a mighty ticklish problem on his hands at that tannery. I understand he's finishing up tonight."

"OK," I answered, "but what's it all about?"

"Well," drawled Bedlam, sliding those four glasses down the length of the bar, "He's running an acceptance test on stokers for two old boilers. It's a 48-hour test and he's finishing up at 5 pm today."

"By golly, I'll drop everything and scoot right over there," I said. "Tell me more about it."

"From what I understand," answered the one-time marine engineer, "the tannery bought the stokers second-hand. They were installed but couldn't feed enough coal to keep steam up like they were supposed to do. So the tannery refused to pay the other half of the bill.

"Marmaduke got wind of that job last month. He called on the tannery and offered to run a test for a fee of $100. But the plant manager got tough and said he wasn't spending another cent on those stokers. Then he got insulting and threatened to have Marmy thrown out of his office if he didn't leave.

"So Marmy was burned up plenty and made up his mind to get even. He hot-footed over to the stoker dealer and offered to run a test for him, with the understanding that if he couldn't make those boilers evaporate their guaranteed output, the test was on him. But if he did make good, he wanted a $500 fee and $50 thrown in for expenses.

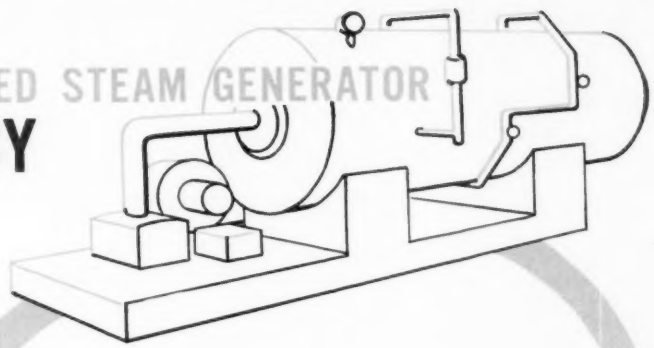
"Well," continued Bedlam, sampling some of his own bottled merchandise, "after a little haggling, they came to terms. Marmy got a letter agreeing to his proposition and $34.50 expenses. If his test makes good, he gets a $298 fee, instead of the $500. Not bad for two day's work. But he's got the dealer over a barrel because how else is the dealer gonna collect the other half of that money for those stokers?

"Things don't look good," added Bedlam. "Last night Marmy was kinda low. Said if he can't pull a fast one, he won't collect a cent because the test is running against him. Said he was taking a suitcase of 'sure-fire evapora-

(*Continued on page* 212)

Ideal Combination

FOR TOP SELF-CONTAINED STEAM GENERATOR EFFICIENCY



1

Nalco WATER TREATMENT

SCALE AND CORROSION PREVENTION

With a Nalco Service Policy and Nalco Chemicals to fit your water treatment requirements, you can keep your self-contained boilers operating indefinitely at top efficiency — without any of the costly difficulties caused by scale and corrosion. This part of the Nalco System was designed expressly to provide small boiler users with the same complete water treatment services enjoyed by thousands of the country's largest power plants. A new 4-page bulletin gives complete details on The Nalco System as applied to the modern self-contained boiler. Your copy will be sent promptly, without obligation.

Write for Bulletin 49

2

Nalco SR-155 FUEL OIL ADDITIVE

FUEL SAVING . . . CLEAN BURNERS

Nalco SR-155 is a *complete* fuel oil additive. It replaces two, three or more single-purpose additives to: (1) keep storage tanks, fuel lines and burners free of sludge and gum; (2) prevent soot formation in the firebox and flues; (3) inhibit corrosion throughout the fuel system; and (4) act as a combustion catalyst to assure complete burning of oil. Fuel savings and reduced maintenance costs usually more than repay the cost of continuous SR-155 treatment — and very little SR-155 is needed per 1,000 gallons of fuel oil! Details on Nalco SR-155 will be sent on request.

Write for Bulletin 46

NATIONAL ALUMINATE CORPORATION

6222 West 66th Place • Chicago 38, Illinois

Canadian inquiries should be addressed to Alchem Limited, Burlington, Ontario

THE Nalco SYSTEM • Serving Industry through Practical Applied Science

JENKINS PRACTICAL PIPING LAYOUTS 61

How to plan a

COOLING WATER SYSTEM FOR REFRIGERATION COMPRESSORS

Facilities needed for cold storage of frozen and perishable foods in supermarkets, hotels, restaurants and institutions are being rapidly expanded, creating a flourishing demand for small refrigeration compressors like the one illustrated here.

In this cooling water system adequate provisions have been made to cope with all emergency conditions. This includes piping for the re-use and conservation of water as required by regulation in many communities. Water is saved by evaporating a small quantity (about 2%) of the recirculating water which lowers the temperature of the remaining water.

To compensate for the evaporated water, and to maintain a constant water level in the pan, city make-up water is metered directly to the pan through a float operated valve. Should the temperature of the water in the cooling system rise above the normal level, fresh water is automatically introduced through a solenoid valve operated by a thermostat in the supply line.

Duplicate water circulating pumps are provided to insure continuous cool water supply to the compressors since water-pressure failure in one will automatically cut in on the standby pump. To provide for the remote possibility of both pumps failing, an alarm system, actuated by a pressurestat in the water supply line, warns the operator to turn on the emergency manually-controlled water supply.

To prevent freezeup in winter, a low temperature aquastat in the supply line controls the cooling fan, shutting it off when water temperature falls to about 45°. This permits the water temperature to rise before the fan resumes operation.

The valve recommended for both the main and emergency water supply shutoffs in this system is Jenkins Fig. 47 Bronze Gate. Engineered to beat wear, it is an excellent valve for steam, water, oil, or gas lines where full, free flow is required.

A tapered solid wedge, with deeply milled lugs for liberal bearing engagement, resists effects of rapidly vibrating steam currents. The traveling spindle, in this type of valve, indicates position of wedge, lifts it entirely clear of the line of flow when valve is fully open. Full thread engagement between bonnet and spindle reduces wear and assures long, trouble-free service.

Like all Jenkins Bronze Gate Valves, Fig. 47 can be repacked under pressure when valve is in an open or closed position. This valve, together with 35 other Jenkins Bronze Gates for all types of service, is described in the folder offered below. Form 131-A. *Consultation with accredited piping engineers and contractors is recommended when planning any major piping installations.*

To save time, to simplify planning, to get all the advantages of Jenkins specialized valve engineering experience, select all the valves you need from the complete Jenkins line. It's your best assurance of *lowest cost in the long run.* Jenkins Bros., 100 Park Ave., New York 17; Jenkins Bros., Ltd., Montreal. Sold through leading Industrial Distributors everywhere.

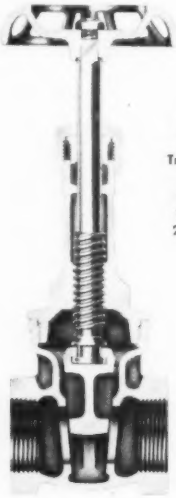


Fig. 47
Solid Wedge
Inside Screw
Traveling Spindle
BRONZE
GATE VALVE
125 lbs. Steam
200 lbs. O.W.G.

SEND FOR THIS FOLDER. It illustrates and describes the complete line of Jenkins Gate Valves, which includes 30 different patterns for various service conditions. Fill out and mail the coupon today.

JENKINS BROS., 100 Park Ave.
New York 17, N. Y.

Please send folder on Bronze Gate Valves.

Name .....

Company .....

Address .....

COOLING WATER SYSTEM FOR REFRIGERATION COMPRESSORS

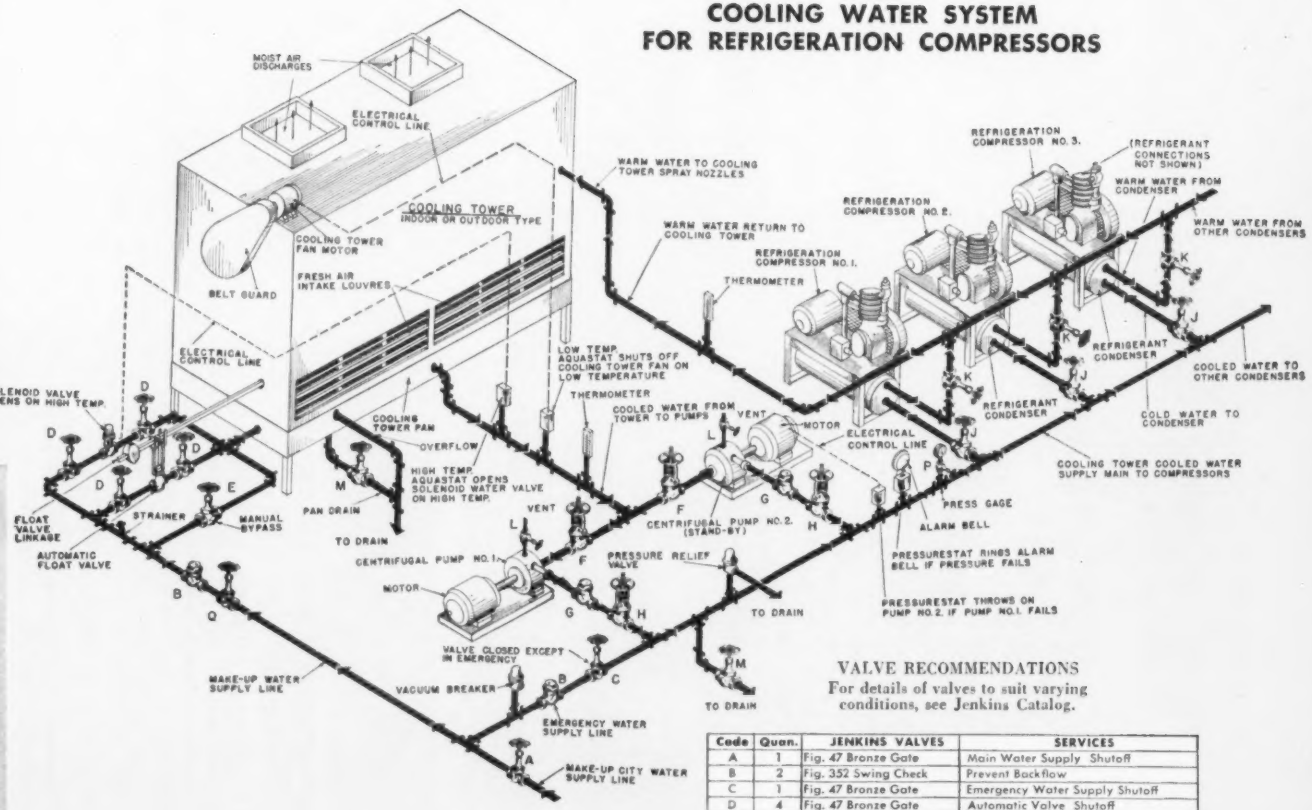


Diagram by Huxley Madeheim
Consulting Engineer

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VALVE RECOMMENDATIONS

For details of valves to suit varying conditions, see Jenkins Catalog.

Code	Quan.	JENKINS VALVES	SERVICES
A	1	Fig. 47 Bronze Gate	Main Water Supply Shutoff
B	2	Fig. 352 Swing Check	Prevent Backflow
C	1	Fig. 47 Bronze Gate	Emergency Water Supply Shutoff
D	4	Fig. 47 Bronze Gate	Automatic Valve Shutoff
E	1	Fig. 106-A Bronze Globe	Manual Bypass of Automatic Valves
F	2	Fig. 368 Bronze Gate	Pump Suction Shutoff
G	2	Fig. 352 Br. Swing Checks	Prevent Backflow to Pumps
H	2	Fig. 368 Bronze Gate	Pump Discharge Control
J	3	Fig. 106-A Bronze Globe	Control Water to Condensors
K	3	Fig. 370 Bronze Gate	Condensor Discharge Shutoff
L	2	Fig. 743-G Bronze Needle	Pump Vent Control
M	2	Fig. 106-A Bronze Globe	Drain Valves
P	1	Fig. 743-G Bronze Needle	Pressure Gage Control
Q	1	Fig. 47 Bronze Gate	Make up Supply Line

Illustrating the proved 3-point formula for trouble-free, time-defying hookups

Use the right type valve for the service

Place valves correctly in the line

Choose Jenkins for lifetime economy

JENKINS VALVES

LOOK FOR THE DIAMOND MARK

SINCE 1864 JENKINS TRADE MARK

DEFENSE DIGEST

Your roundup of mobilization news and trends affecting power men

Bigger power-expansion program calls for 32 million kw of new generating capacity for Class I utilities in the 3-yr period 1952-54: 9 million in 1952, 11 in 1953, 12 in 1954. This will bring total Class I capacity (95% of public supply) to 107 million kw, 57% larger than at end of 1950.

Hope is that official setting of this goal will ease some of the industry's problems. Materials shortages, particularly forgings and steel castings, have held up deliveries of large turbine-generator units as much as three or four months. Similar tightnesses have plagued manufacturers of other equipment and delayed utility construction work.

Bigger allotments and increased advance allotments for long-lead-time items should pull program back to schedule. Manufacturers believe present facilities plus planned expansion will handle needed equipment-production increase.

Easing in materials situation continues but it's still too soon to throw any hats in the air. Controlled materials allotments for the third quarter were up but held a lot of "water." CMP tickets to industry added up to far more than supply. With many consumer-goods lines "soft," mobilizers apparently expect business to turn back a good fraction of tickets issued.

In asking for 4th quarter statements of requirements from Class I utilities, Defense Electric Power Administration suggested taking advantage of greater apparent availability of certain materials, particularly structural steel and aluminum, by listing needs for projects previously deferred.

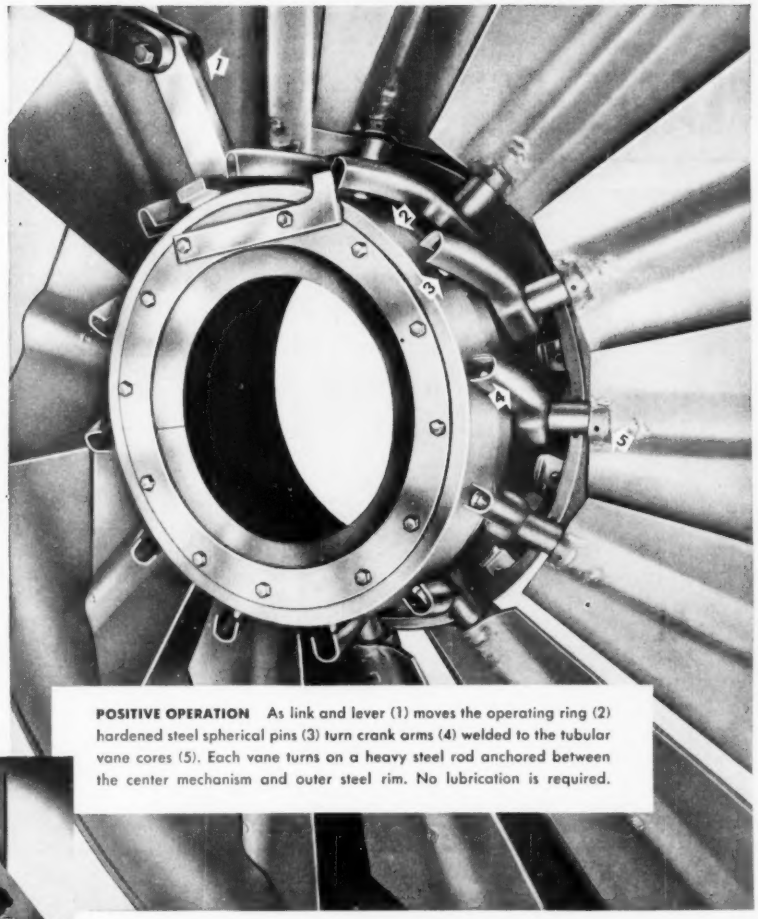
Mobilization is over the hump in some respects, says ex-director Charles E. Wilson in his final report. Output of machine-tool industry will hit its leveling-off rate in a few months. Period of severest shortages in basic materials seems past. Some controls have been removed or relaxed, time when others can be removed is not far distant. But, he warns, an extended shutdown in any of the basic materials industries would reverse the trend and extend the period during which allocation controls must be imposed.

Keeping our long-range strength for an indefinite period poses problems never before faced by government and industry, Wilson points out. Here are some of them: (1) Military equipment produced in next few years will have to be constantly modernized. (2) Facilities needed to enable us to expand military production to high levels quickly must be completed and systematically maintained. (3) A minimum set of controls may have to remain in effect after the buildup period. Answers to these problems must be further worked out in months ahead.

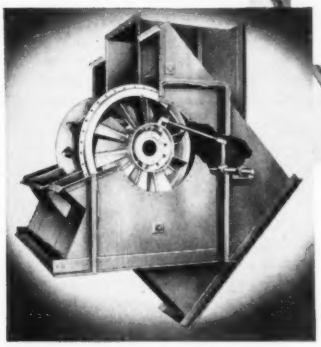
Large needs for electric power in industrial projects will be more closely coordinated with the power-expansion program under a new procedure set up by Defense Production Administration. All claimant agencies allocating materials for industrial construction must consult Defense Electric Power Administration before taking action on any project involving 2000 kw or more of ac power.

DEPA will direct DPA's attention to all cases where review indicates proposed location would cause competition for electric power with existing or proposed defense industries. New CMP Form 4-C provides space for applicant to list information on power requirements. Applicants and claimant agencies are asked to examine power-supply question in formative stages of any project.

SAVE POWER WITH CONSTANT SPEED MOTORS



POSITIVE OPERATION As link and lever (1) moves the operating ring (2) hardened steel spherical pins (3) turn crank arms (4) welded to the tubular vane cores (5). Each vane turns on a heavy steel rod anchored between the center mechanism and outer steel rim. No lubrication is required.



Operating mechanism is shielded from the gas stream but is readily accessible from the outside for inspection and maintenance.

VANE CONTROL

CAN SAVE BOTH FIRST COST AND OPERATING COST

The combination of Sturtevant Vane Control and the simple squirrel cage motor is less costly to install and provides greater overall power savings than other types of mechanical draft control. These savings are made possible by simplified design.

Vane Control has no gears—no backlash. It provides instantaneous control of draft. The vanes move rapidly in the open range, yet fine adjustment is possible in the near-closed position. Extremes of heat and cold do not affect its operation.

In any comparison of fans and their control mechanisms for use in mechanical draft, as well as industrial applications and ventilating service, you will find Vane Control is both the most efficient and the most economical choice. For full information ask for Folder DB-92-810. Contact your local Westinghouse-Sturtevant office, or write Westinghouse Electric Corporation, Sturtevant Division, Hyde Park, Boston 36, Mass.

TUNE IN ON HISTORY! Only Westinghouse brings you complete coverage of four-month political campaign over CBS television and radio.

YOU CAN BE SURE...IF IT'S

Westinghouse J-80264 **STURTEVANT DIVISION**

READER SERVICE SECTION

POWER NEWS 160
TECHNICAL BRIEFS 162
PLANT EQUIPMENT NEWS 166
NEW FREE BULLETINS 175

SCRAP SHORTAGE, NATIONAL CRISIS

Steel-making capacity in the U.S.A. keeps growing steadily, 108,000,000 tons today; 118,000,000 tons by 1953. Scrap yard, above, shows supply still lags demand; needs bolstering

WORLD'S FASTEST COAL UNLOADER

Fastest most efficient coal-barge unloader delivers 1350 tons per hr by means of an 83-ft bucket-type elevator to the coke plant of Jones & Laughlin Steel Corp's Aliquippa Works

Air Conditioning: Full Speed Ahead?

► THIS YEAR THE AIR CONDITIONING industry celebrates its fiftieth anniversary. When Dr W H Carrier launched it to solve a 1902 production problem in a lithographing plant the baby industry's total sales grossed only a few thousand for that year and the next few. In 1951 cash outlays for air conditioning of all types passed $1 billion for the first time.

In view of such a sturdy growth, what's ahead for air conditioning? In a recent speech to the stockholders of Carrier Corp, Cloud Wampler, president of the corporation, painted a very promising picture. He sees a $5 billion industry within the next half century.

Competition and the spur to greater productivity and employee efficiency will be the keys to this vast market. The day will come, Wampler feels, when people will no more tolerate discomfort from summer heat in their homes than they do the winter cold today.

The principal air conditioning markets are (1) multi-story buildings like offices, hotels, apartments (2) stores, shops (3) industrial plants (4) residental buildings. All but the residential field are in the market on a wide scale today with every prospect that their demand will grow.

Practically no new multi-story buildings are going up without air conditioning systems that can handle the complete building load. The big factor in making this market an immediate one is the use of high velocity conditioned air supply ducts. These ducts greatly reduce initial metalwork and equipment costs.

Competition from these new air-conditioned buildings is likely to force older, existing buildings to put in air conditioning to hold tenants and attract guests. The result, more business.

For Coming Events turn to page 208

The shop and store field has opened up considerably within the past year or so. Self-contained units have been a major force in prying this market open. These smaller, compact, for the most part mass-produced air refrigerating and humidifying devices can give as complete air conditioning as desired and at relatively low costs. These two advantages combine to make air conditioning attractive to thousands of shops and stores now in business. Further, as the use of air conditioning spreads among them competition will force the laggards into the market.

Industrial processes are the third and most immense immediate market. In some manufacturing processes air conditioning is an absolute necessity; in others, it helps make goods better, faster and cheaper. With such positive

(*Continued on page 206*)

"Tycol Aturbrio never lets you down... turbines run for years without trouble"

How true! Tycol Aturbrio Oils are "double inhibited" to prevent oxidation and rusting. They provide maximum resistance to emulsification . . . permit continuous operation without sludge formation — performing for years without an oil change, completely eliminating, in many cases, down-time-high-cost maintenance.

Complete and detailed information on Tycol Aturbrio Turbine Oils is available from your nearest Tide Water Associated office. Call or wire today.

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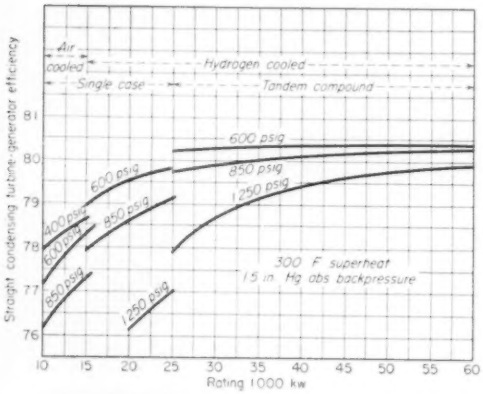
17 BATTERY PLACE - NEW YORK 4, N. Y.

SEND FOR A FREE COPY OF "TIDE WATER ASSOCIATED LUBRICANIA"

TECHNICAL BRIEFS

Latest engineering developments for busy power men

11 Digests for you on:
STEAM GENERATION
PRIME MOVERS
GAS TURBINES
HEAT PUMPS



TURBINE EFFICIENCY increases with larger steam flow as simple straight condensing performance curves show

TREND OF MAINTENANCE EXPENSES

Composite of All U. S. Class A and B Private Utilities

YEAR	1941	1942	1943	1944	1945	1946	1947	1948	1949	1950
STEAM GENERATION										
Billion kwhr	106	114	134	144	133	134	163	184	186	215
LOAD FACTOR	33.8	34.7	39.1	41.2	37.5	37.9	44.2	46.1	42.0	44.4
PRODUCTION EXPENSE										
Mills per kwhr										
Fuel	2.36	2.42	2.64	2.75	2.81	3.10	3.61	4.17	3.73	3.49
Other	0.56	0.62	0.60	0.61	0.72	0.72	0.70	0.71	0.77	0.71
Maintenance	0.38	0.39	0.40	0.51	0.60	0.58	0.59	0.60	0.63	0.56
Miscellaneous*	0.08	0.07	0.01	0.01	0.01	0.02	0.03	0.01	0.02	0.02
Total	3.38	3.50	3.65	3.88	4.14	4.38	4.87	5.47	5.11	4.74
INSTALLED CAPACITY										
Steam Generation, beginning of yr										
Million kw	36.0	37.4	39.1	39.7	40.3	40.3	42.0	45.4	50.5	55.2
MAINTENANCE EXPENSE										
$ per kw-yr	1.12	1.20	1.36	1.83	1.98	1.78	2.30	2.41	2.33	2.18

Data from FPC reports

*For 1946-1950, miscellaneous item is a credit

Steam Generation

Steam Turbine-Generators for Industrial Plants. *By S D Fulton, Westinghouse Electric Corp.*

In general, power produced in an industrial plant is a by-product of steam required for process purposes. The current high cost of power plant equipment and the relatively low cost of purchased power makes necessary careful studies to determine whether: (1) All electric power should be purchased. (2) Power should be generated by noncondensing turbines serving as reducing valves for process steam with a public utility tie line as a source of firm power. (3) Power should be generated by non-condensing and/or condensing extraction turbines with or without public utility tie line.

The first step in selecting steam and power generation equipment is to establish the requirements. This includes electric power demand, process steam demand — quantities, pressures and temperatures — balance between steam and power demands under various operating conditions, hot and cold water requirements.

Experience with high pressure turbines in industrial plants shows that steam conditions depend primarily on economics. Reliable equipment is available for pressures up to 1250 psig and 900 F, even in small sizes. Water treatment suitable for even the high temperature, high make-up installations has been developed. Temperatures at the turbine exhaust or extraction opening need not be a determining factor in selecting steam conditions since a spray type desuperheater or a thoroughfare desuperheating heat exchanger can reduce the temperature to or near saturation. Also, condensing processes can tolerate a considerable amount of superheat since the condensing temperature is determined by the condensing pressure and not the total temperature of the steam. With due consideration of such limiting factors as existing equipment, piping, etc., steam conditions should be chosen to give the lowest overall manufacturing costs and not necessarily to give the highest yield of electric power.

Steam turbine generators with sensitive and flexible control systems can be provided to meet any requirement in industrial plants. Careful selection of types, ratings and initial steam conditions with due consideration of local conditions will provide an economic source of electric power. *ASME Paper, Seattle meeting, no number.*

Maintenance Effects on Design of Steam Power Plants. *By B C Mallory and F W Argue, Stone & Webster Engrg Corp.*

For the past decade maintenance costs in steam power plants have risen faster in proportion to total production expenses than fuel and operating costs. This paper discusses some of the methods employed by power plant designers in an effort to arrest or reverse this trend. They are providing adequate space for maintenance and including in the plant layout enough of what might be called "broom closets."

The trend of maintenance for the past ten years as compared with fuel and operating costs shows in table. These data have been taken from Federal power reports of all U.S.A. Class A and B private utilities. Using the 1941 and 1950 figures shown, the installed capacity increased slightly over 50% while the load factor increased from about 34 to 44%. The fuel costs per kwhr rose about 50%, maintenance costs about 50%, and other costs, including operation, only about 25%. However, maintenance expressed as dollars per kw-year of installed capacity increased nearly 100%. To say the same thing another way, for the average steam plant in 1950 it cost about twice what it did ten years before to keep capacity in service, even though only one-third of the capacity is new.

Generally speaking, maintenance may be reduced by (1) installing equipment that has demonstrated its reliability, (2) selecting equipment that may be

How to make packings last longer

Tips by Johns-Manville Engineers to help you keep production rolling

Keep equipment in repair for best packing service

Worn shafts wear me down

Trying to make packing compensate for excessive shaft or rod wear will shorten packing life materially without alleviating the undesirable condition. Pack correctly to avoid excessive shaft and rod wear. Replace worn shafts and rods as soon as possible to avoid adding the expense of damaged packings to the cost of parts replacement.

"Bucking" shafts throw me!

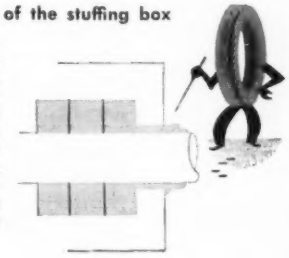
Packings are for sealing only. Trying to compensate for shaft misalignment or vibration by overpacking and excessive gland pressure results in scored shafts and ruined packing. Think of a stuffing box as a potential brake assembly that may develop considerable frictional resistance with attendant heat and wear.

Keep my lantern clear

If the stuffing box is equipped with an oil, grease or water lantern, its purpose is defeated when the lantern ring is omitted or the opening blocked by improperly installed packing or other obstruction. This can deprive the packing of lubrication or cooling and result in premature failure.

Don't let me get out of the stuffing box

If the shaft or rod is badly worn, the packing may be extruded into the system when the gland follower is taken up. Considerable difficulty such as packing getting into valves or traps or contaminating the fluid handled may result. Rebush the stuffing box or use a junk ring to reduce the clearance.



Why you can expect maximum service from

CENTRIPAC ROD PACKING Style No. 7

Made from long fibre asbestos yarn, plaited (not pressed) square, thoroughly lubricated and graphited, J-M Centripac has been, for many years, a preferred high-quality packing for centrifugal pumps and other equipment with rotating or oscillating rods. You can count on it to stand up against water — fresh, salt, hot or cold — oil, ammonia, brine, gasoline and some weak acids and chemicals.

Your distributor will help too! Your J-M Packing Distributor can help you take the guesswork out of packing problems. He carries complete stocks of Johns-Manville quality packings and can supply you promptly. For the address of the J-M Packing Distributor nearest you, write Johns-Manville, Box 60, New York 16, N.Y.

JOHNS-MANVILLE JM PRODUCTS

Johns-Manville PACKINGS & GASKETS

More TECHNICAL BRIEFS

Begins on page 162

disassembled, repaired if necessary, and assembled again readily, (3) providing facilities to permit rapid overhaul, (4) keeping equipment in good operating condition by periodic overhauls rather than waiting for a breakdown to occur.

This paper deals with providing space and facilities for rapid overhaul or replacement and for "broom closets" to improve the accessibility of maintenance tools and equipment. *ASME Paper. No. 52-S-12.*

Experimental Superheater for Steam at 2000 Psi and 1250 F. *By F G Ely and F Eberle, Babcock & Wilcox Co.*

To investigate the properties of new superstrength alloys for high-temperature steam-superheater service, a test element constructed of 2-in. OD alloy tubes was installed in an operating boiler at Twin Branch Plant. It was supplied with steam at 2000 psig, 950 F, that was heated to 1250 F. Operating conditions, and results of the first 5000 service hours are described in this paper. The test is being continued for thorough evaluation of the materials.

In the use of steam for power generation, there has been a steady increase in operating pressures and temperatures. The objective is to improve cycle efficiency and produce more electrical energy per pound of fuel burned. Limitations upon this trend are imposed chiefly by the characteristics of the currently available materials of construction. As new developments improve those materials, advances can be made in the design of power-plant equipment.

For the steam-generating phase of the cycle, it is well recognized that the critical limitations on using higher steam temperature lie in the materials of which the final superheater stages are constructed. These pressure parts must be resistant to oxidation, or to other forms of corrosive attack, by steam or by the products of combustion at elevated temperatures. They must possess sufficient strength and related physical properties at these temperatures to withstand the stresses due to internal pressure, heat transfer, and structural loading encountered in normal operating service. Furthermore, as a matter of foremost consideration, they must be capable of being produced commercially in the form of tubes, and must have welding characteristics suitable for dependable fabrication. *ASME Paper. No. 51-A-37.*

Behavior of Superheating Tubing Materials. *By H A Blank, A M Hall, and J H Jackson, Battelle Memorial Institute.*

With steam temperature of central-station boiler plants advancing to 1050 F in new installations today, and with indications that steam temperatures of 1200 F are not too far in the future, selecting suitable materials for superheater and reheater tubing requires special consideration.

Alloys having good service characteristics at 1100 to 1350 F are required to meet the foregoing steam conditions. While mechanical properties of such alloys are not too serious a problem, the matter of corrosion resistance is critical. The ASME Special Research Committee on High-Temperature Steam Generation recognized the importance and complexity of the corrosion problems. They sponsored a comprehensive program to evaluate commercially available alloys for suitability as superheater and reheater tubing at metal temperatures up to 1350 F.

The program divides into two broad parts. One is concerned with the reaction of high-pressure high-temperature steam on such materials. The other deals with corrosion by flue gases and slag-forming ash on the external surface of the tubing, and is divided in turn into two phases. One phase aims to evaluate the alloys' resistance toward corrosion by the combustion products of the various fuels used for boilers, under actual field conditions. The other phase, carried out in the laboratory, aims to investigate the effect of certain components of a combustion atmosphere on the rate of corrosion of the same alloys.

This paper is concerned with the field-test phase of the program carried out at Battelle. The laboratory work will be the subject of a future paper. *ASME Paper. No. 51-A-42.*

TO OBTAIN COMPLETE TEXT

Material for these abstracts comes from the following sources unless otherwise stated. Order complete paper from source not POWER.

American Society of Mechanical Engineers, annual meeting, Haddon Hall, Atlantic City, N. J., Nov. 26-29, 1951. Identified by initials ASME and obtainable through ASME, 29 W 39th St, New York 18, N. Y.

American Society of Mechanical Engineers, spring meeting, Univ of Washington, Seattle, Wash., March 24-26, 1952. Identified by initials ASME and obtainable through ASME, 29 W 39th St, New York 18, N. Y.

Prime Movers

Thermal Performance of Modern Turbines. *By H R Reese and J R Carlson, Westinghouse Electric Corp.*

This paper answers many questions on the generation of electrical energy. It provides information to plan future economical power plants and to evaluate power plants, figure p162. Following points are covered.

1. Heat rate information of turbine generator units operating on the regenerative heat cycle for capabilities of 75,000 to 200,000 kw for 5 basic steam conditions.

This together with previous publications covering turbine generator units of 12,650 to 100,000 kw provides useful data for a wide range of ratings.

2. Heat rate information at the turbine capability for sizes from 75,000 to 200,000 kw operating on the regenerative and reheat cycle.

3. Heat rate data for turbine sizes and steam conditions that are considered practical combinations. Initial steam conditions are suggested, which for average fuel costs and load factors, should result in economical installations.

4. Recommended temperature of the feedwater returning to the steam generator for the 5 basic steam conditions.

5. Means of calculating the steam flow required at turbine capability.

6. Method of calculating the steam flow to the condenser.

7. Method of calculating the steam flow and heat to be added to reheat turbine generator units.

8. Information to show the optimum final feed temperature and the reduction in heat consumption for various stages of feedwater heating for steam conditions of 1450 psig, 1000 F, and 1800 psig, 1050 F.

9. Correction factors for variations from the basic conditions in steam pressure, temperature, vacuum, number of heaters and final feed temperature. *ASME Paper. No. 51-A-81.*

Research in Exhaust Manifolds. *By P H Schweitzer, Pennsylvania State College.*

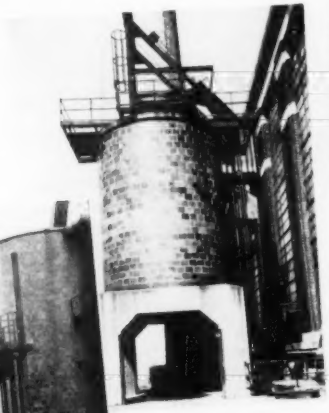
In all the efforts to extract more power from every pound of fuel burned in an internal combustion engine, the important role of the exhaust pipe has been largely overlooked. This is the

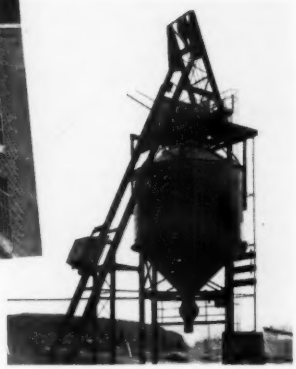
(*Continued on page* 198)

FAIRFIELD SERVES THE NATION'S POWER PLANTS

SKIP HOISTS IN *action*

■ Yes, Fairfield Skip Hoists in action mean constant, automatic, trouble-free service for countless power plants across the U.S. And they are a typical example of unit performance found in every element of Fairfield Coal and Ash Handling Systems. For Fairfield Systems are engineered by experienced "power-house" specialists—constructed carefully in Fairfield shops—and properly erected under Fairfield supervision in the field. Yes, this triple-service from one source spells profitable operation in the years ahead for your planned power house expansion or new construction. Write us today for a Fairfield Engineer's call and profitable recommendations—there's no obligation.





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Write today for your free copy of Bulletin 650 which illustrates and describes typical boiler house layouts. It can be helpful in your planning for expansion or new construction.

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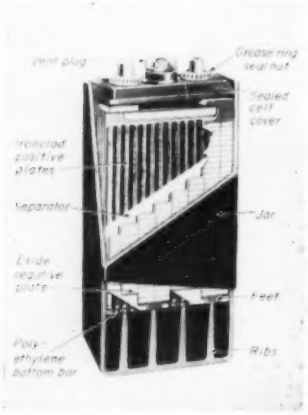
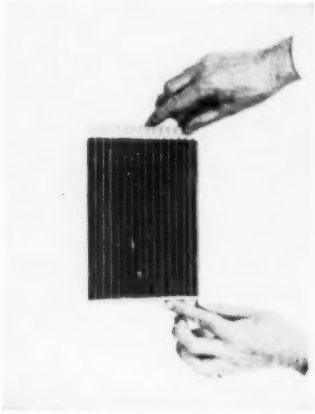




LONGER BATTERY LIFE is claim with corrosion resistant positive plate made from an alloy of silver, lead and other components. Core rods are inserted in slotted rubber tubes, and active material is packed in tubes surrounding rods. Small leakage of active material is further cut 50% by new non-corrosive polyethylene tube-sealing bottom bar, adding to battery life

IMPROVED POSITIVE PLATE INCREASES INDUSTRIAL BATTERY LIFE

P548 • Positive plate of storage battery is all important factor in determining useful battery life. An improvement in positive grid construction of the *Ironclad* battery is made with the development of Silvium metal, an alloy of silver, lead and other components, that is highly resistant to corrosion.

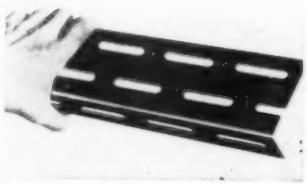
This positive plate is different from all others. It consists of core rods inserted in slotted rubber tubes. Active material is then packed in the tubes surrounding the rods. Fine slots in the rubber tubes permit free access of electrolyte to the active material, but prevent the latter from washing out.

Previously, bottoms of the tubes were closed with an alloy bar. But after considerable service, due to corrosive action on the metal bar, some of the active material would seep out into the bottom of the container forming a sediment. This sediment represented not only lost capacity and life but also possible trouble from short circuits.

The second improvement in the *Ironclad's* positive plate is that the metal bottom bar is replaced by a polyethylene one that will be a permanent plug or tube sealer. It is permanent because it is unaffected by electrolyte or electrolytic action. The important result is that the positive active material is held in place for a longer working life.

Polyethylene is also an insulating material. It extends across the entire bottom of the plate and acts as a safeguard against shorts between plates. Finally, elimination of metal at bottom of the positive plates assures better negative plate performance because of low local action and the reduction or elimination of shedding.

Other improvements are new homogeneous sealing compound; seamless, shockproof jar; corrosion and knock resistant, plastic steel tray coating; and unbreakable plastic vent plugs. The battery is used for railway, motive power, heavy-duty service. **Electric Storage Battery Co, Philadelphia 2, Pa.**



For more data on these items, use post cards, p 175. Identify request with P and number.

ALL-PURPOSE FABRICATING UNIT

P533 • *DexAngle*, a 10-ft long, 3x1.5x 0.080-in. slotted-leg galvanized-steel angle is designed for all-purpose industrial fabrication. Lengthwise rows of slots in this "industrial erector set" unit permit rapid assembly by bolting of shelves, bins, motor and machinery mounts, conveyor-line structures, machine guards, hand rails, etc. A hacksaw and wrench are the only tools needed for assembly, and all sections are reusable.
Acme Steel Co, 2840 Archer Ave, Chicago 8, Ill.

TEMPERATURE REGULATORS·P550

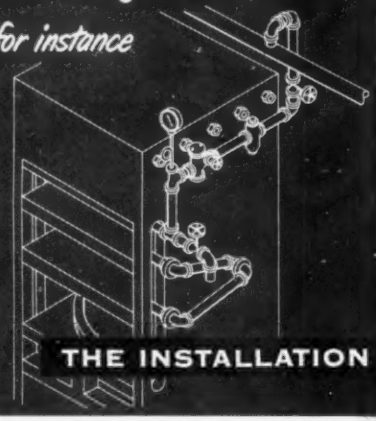
Self-operated temperature regulators known as Type UBA, are packless, single seated, fully balanced, and hermetically sealed for reliable operation under the most adverse conditions. Handy visual control is provided by dial adjustment on top of regulator. Unit is available in ¼-, ⅜- and ½-in. sizes for steam pressures to 150 psig, and temperatures between 30 and 325 F with control acting over a 60 F range. **Farris Stacon Corp, 627 Commercial Ave, Palisades Park, N. J.**

(*Continued on page* 168)

Will Your Pressure Regulators Last 25 Years?

...on Molding Press Service

for instance



THE INSTALLATION

Crane Brass Pressure Regulators on steam lines to rubber molding presses; Dryden Rubber Division, Sheller Mfg. Corp., Chicago. 225 units in service.

VALVE SERVICE RATINGS

FEATURES:	Equally good on steam or air
SUITABILITY:	Steady outlet pressure - no drift
MAINTENANCE COST:	Routine servicing only
SERVICE LIFE:	Many installed more than 25 years — Still O.K.
OPERATING RESULTS:	Fully automatic steam control at lowest cost
PRICE:	Good Buy - has no equal
AVAILABILITY:	Stock item in Crane Line

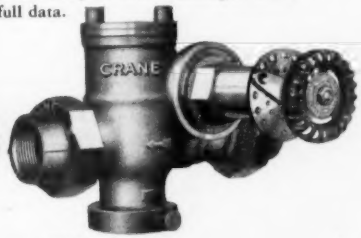
THE HISTORY

Steam generated at 130 psi is reduced through individual regulators on molding presses. Pressure used at machines is 60 to 100 psi depending on work. Features of regulator service needed most are: (1) non-fluctuating outlet pressure automatically maintained within close regulation; (2) easy adjustment by press operator to specified pressure for given work.

More than 25 years ago the plant standardized on Crane Regulators, a total of 225 being in use today. Many are the original installations, still delivering desired outlet pressure. Records for all regulators, regardless of age, show no maintenance cost other than prescribed simple routine servicing. On old models of the Crane 960 regulator, after prolonged service, this includes occasional regrinding of seats.

THE VALVE

Crane No. 960 Brass Pressure Regulators reduce steam or air pressures up to 250 psi, to within 80% of inlet pressure. Factory pre-set to operate within any of 4 ranges from 1 to 200 psi, with easily selected service pressure within set range. Precision made; fully automatic; highly dependable, even under reasonable fluctuation of inlet pressure. All wearing parts renewable. See your Crane Catalog or Crane Representative for full data.



The Complete Crane Line Meets All Valve Needs. That's Why—

More Crane Valves Are Used Than Any Other Make!

CRANE VALVES

CRANE CO., *General Offices:* 836 S. Michigan Ave., Chicago 5, Illinois

Branches and Wholesalers Serving All Industrial Areas

VALVES • FITTINGS • PIPE • PLUMBING • HEATING

More EQUIPMENT NEWS

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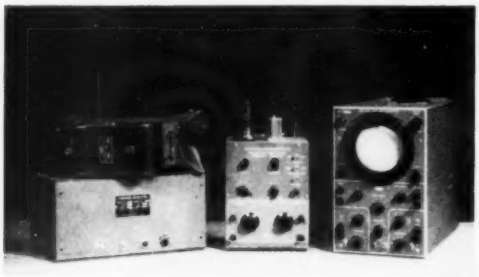
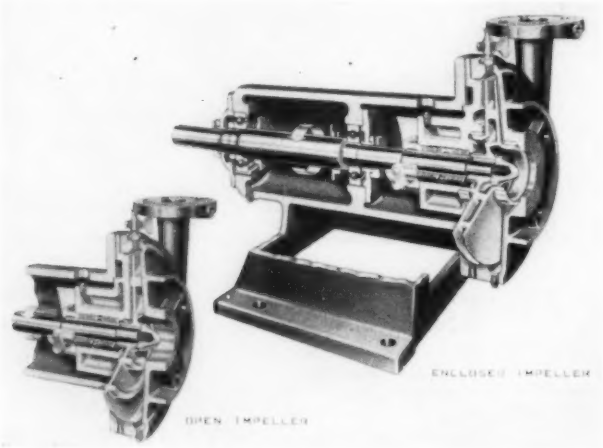


ELECTRONIC CAM SHAFT AND PROFILE INSPECTION TESTER

P547 • Designed for use in the automotive and mechanical industries, the *Type 126* electronic cam shaft and profile inspection tester enables measurements to .0001 in. The contour presentation is displayed on the cathode ray oscillograph, and curves of velocity, displacement, or acceleration may be obtained. The cam pushes a rod-shaped permanent magnet back and forth inside a pickup coil which generates a voltage proportional to velocity, and this voltage is integrated to obtain displacement, or differentiated to get acceleration. This system may also be used directly on engine to study valve motion at high speed.

The following instruments are contained in this unit: (a) cathode ray oscillograph and polaroid land camera, (b) velocity pickup assembly complete with alnico magnet and synchronization pickup, (c) integrator, differentiator and calibration circuits, (d) voltage regulator.

Sterling Instruments Co, 13331 Linwood Ave, Detroit 6, Mich.



CHEMICAL PROCESS PUMP FOR HOT OR COLD LIQUIDS

P508 • *Type DS* pump is designed for hot or cold process liquids handled in moderate quantities against low, medium or high heads. It is especially suitable for corrosive and abrasive liquids with solids in suspension up to 5% by volume. Discharge sizes range from 1 through 6 in. Capacities go up to 600 gpm with an enclosed impeller, to 1000 gpm with an open impeller. Heads range to 231 ft. Driver is standard horizontal electric motor mounted on common base with pump.

Pump is offered in two basic designs: one is grease-lubricated, the other oil-lubricated. Grease is used for temperatures to 250 F, oil between 250 and 600 F. But oil may also be used to 250 F if desired. Cooling coils in oil-lubricated units keep oil at proper temperature. Several size liquid ends can be used on each size pump bracket.

Peerless Pump Div, Food Machinery and Chemical Corp, 301 West Ave 26, Los Angeles 31, Calif.

VALVE-SEAT GRINDER • P551

Portable valve-seat grinder is especially designed for large internal-combustion engines with inside seat diameters from 2 15/16 to 12 in. Unit can be used to grind both valve-seat faces and counterbores within the size range, and regularly holds concentricity to 0.003 in. It does in a few minutes what might take hours by ordinary reaming and hand lapping methods. Grinder may be used in shop or directly on engine—wherever air pressure is available. It consists essentially of a grinding unit with easily accessible controls, a wheel dressing unit and an air-motor drive. Grinding wheel turns at 12,000 rpm. Diamond tool performs dressing operation with any angle from 0 to 90 deg obtainable. Air pressure from 90 to 125 psi from a high-volume tank is recommended.

Thompson Products, Inc, 8354 Wit-Cox Ave, Bell, Calif.

For more data on these items, use post cards, p 175. Identify request with P and number.

SCANNING SYSTEM

P512 • Continuous and automatic monitoring of 270 separate temperature points is possible with manufacturer's *ElectroniK* scanning system. It consists of a recorder, rectifier and control unit. Alarm gives a visual or audible indication when temperature at any one point exceeds the desired limit. The operator can switch to manual control if he so desires, further he can select the kind of record the machine makes —recording only when a set point is exceeded, or recording all points continuously, or recording none and scanning only to sound alarms, or recording only manually selected points. Instrument is said to work well in boiler tube temperature recordings and similar services.

Brown Instruments Div, Minneapolis-Honeywell Regulator Co, Wayne and Windrim Ave, Philadelphia 44, Pa.

ELECTRIC BOILERS • P552

Two new models, *LP-1½* and *400—1½*, complete the manufacturer's line of Speedy-lectric *Model LP* boilers. The new designs are available for 220-, 440-, or 550-v single-phase power. They are compact, 14 in. wide, 22 in. long, 28 in. high, and require 15-kw power input for maximum steam output.

Model 400—1½ is an ASME Code boiler carrying National Board Stamping & Insurance Co certificates for pressures up to 50 psi. Both boilers have Underwriters' listing. Automatic balanced control adjusts the current consumption to the exact amount required to maintain desired steam output, pressure and temperature.

Livingstone Engineering Co, 100 Grove St, Worcester 5, Mass.

(*Continued on page* 170)

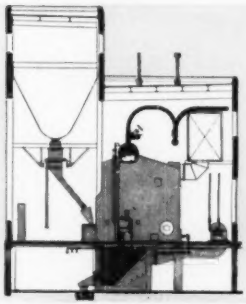
"74.2% MORE STEAM PER DOLLAR-

that's what this modern coal installation gives us at Perfection Stove Co.!"

says George I. Chittenden, consulting engineer for the Perfection Stove Company.

Perfection's old installation, if operating today, would generate 1,362 lbs. of steam per hour per dollar. The new plant produces 2,373 lbs. of steam per hour per dollar. Here's proof of the economy and efficiency of bituminous coal burned with modern equipment.

This view of Perfection Stove's new steam plant shows the coal elevator and ash silo. Coal is delivered through an under-track hopper, lifted by elevator to storage. A pneumatic system carries ashes to the silo.



This sectional drawing of the plant's boiler installation shows the coal bunker over the firing aisle. A weigh larry with dust-proof connection feeds coal to the stokers. The plant is clean and efficient—typical of the modern design that makes full use of coal's inherent advantages.

If you operate your own steam plant, you can't afford to ignore these few down-to-earth facts!

COAL in most places is today's lowest-cost fuel.

COAL resources in America are adequate for all needs—for hundreds of years to come.

COAL production in the U.S.A. is highly mechanized and by far the most efficient in the world.

COAL prices will therefore remain the most stable of all fuels.

COAL is the safest fuel to store and use.

COAL is the fuel that industry counts on more and more—for with modern combustion and handling equipment, the inherent advantages of well-prepared coal net even bigger savings.

● More and more consulting engineers are advising their clients that *bituminous* coal is the best buy for steam fuel. *Here's why:* Nearly everywhere coal yields more BTU's per dollar . . . modern combustion installations step up this inherent economy . . . up-to-date coal- and ash-handling systems cut labor costs to a minimum.

Tremendous reserves give coal a future dependability of supply no other fuel can offer. And to mine this coal, America has the world's most productive and efficient coal industry—making coal the one fuel most likely to remain reasonably stable in price.

If you're building or planning to modernize a steam plant, call in a competent consulting engineer. He'll show you how a modern coal installation can save you money and do a more efficient job, too!

BITUMINOUS COAL INSTITUTE
A Department of National Coal Association
WASHINGTON, D. C.

FOR HIGH EFFICIENCY ★ FOR LOW COST

YOU CAN COUNT ON COAL!

More EQUIPMENT NEWS

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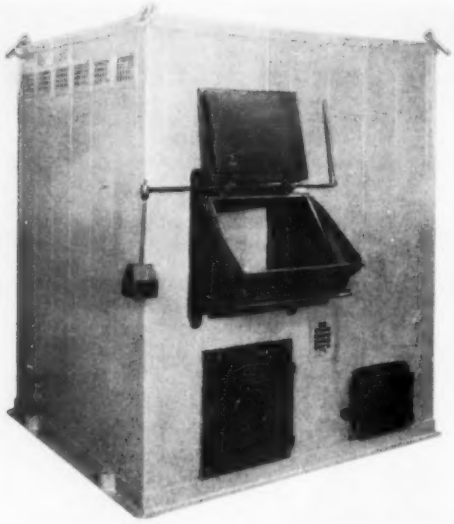


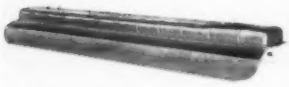
INCINERATOR FEATURES PACKAGED DESIGN

P519 • Previously marketed incinerator, the FG4, for on-the-site assembly is now available for packaged delivery, factory-assembled with sections of factory-lined stack. When erection areas permit handling and installing the packaged unit, this design is preferred.

Each firebrick in the arches is hung on cast-iron hangers, and sidewall courses also include supports. Freeing the brickwork from mechanical stress allows each piece to adjust itself under temperature changes so maintenance is low.

Waste product burning takes place within a single charging chamber and two separate and distinct secondary combustion chambers that follow it. Combustion is so complete that venting is possible through the self-supported refractory lined steel stack.

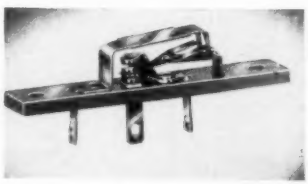
Brule Incinerators, 407 S Dearborn St, Chicago 5, Ill.



INDUSTRIAL LUMINAIRE

P535 • A streamlined version of the standard design, new industrial luminaire, *2FPR-90*, can operate two T-17 mogul fluorescent lamps rated 85, 90, or 100w. A lamplock holds lamps in high vibration areas. Rigid lampholder support, snap-in chain mounting bracket, and indexed starters are standard.

Westinghouse Electric Corp, Box 2099, Pittsburgh 30, Pa.



MINIATURE SWITCH

P534 • Requiring space of 1¼x5/16x⅝ in. exclusive of terminals and terminal strip, miniature *Type E* switch will handle resistive loads of 10 amp at 125 v and 5 amp at 250 v ac. Contacts have positive wiping action making switch adaptable for tungsten-filament lamp loads. Terminals are integral with contact supports.

W L Maxson Corp, Unimax Switch Div, 460 W 34th St, New York 1, N.Y.

MERCURY LAMP

P553 • The first mercury lamp for general lighting service to have reflectors built into the bulb, these two 400-w lamps housed in the R-52 bulb never need cleaning or other maintenance. They have a life rating of 3000 hrs at 5 hrs per burning start, and 4000 hrs at 10 hrs per start.

The H400-R1 generates light of the regular mercury color, and has a lumen output of 14,500. The H400-RC1 is physically the same except for a coating of phosphor on the inside face of outer bulb. This improves color quality of light, particularly in its effect upon the human complexion, and helps smooth out light beam. This lamp has an output of 10,000 lumens.

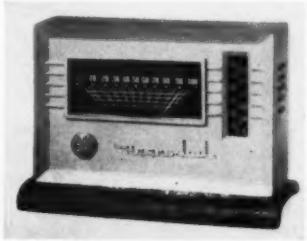
General Electric Co, Nela Park, Cleveland 12, Ohio

For more data on these items, use post cards, p 175. Identify request with P and number.

CONTROL THERMOMETERS

P513 • Snap-acting, electric contact control *Electr-O-Vane* thermometers can be furnished for eccentric scale indicators or for one- or two-pen recorders. In two-pen systems a pressure element can replace one of the thermal systems. Units are vapor, gas or mercury-actuated as specified, with necessary ambient temperature compensations made as part of the meter assembly. Calibrations, ranges, charts and chart drives are supplied to meet requirements.

Brown Instruments Div, Minneapolis-Honeywell Regulator Co, Wayne and Windrim Ave, Philadelphia 44, Pa.



HUMIDITY AND TEMPERATURE INDICATOR

P510 • *Hygrodial* is a direct-reading instrument that shows at a glance the relative humidity and temperature of the air to which it is exposed. Humidity scale is 2½ in. long and graduated in equal divisions covering the range from 0 to 100% relative humidity. Temperature scale is 1½ in. high and covers a range of 0 to 100 F. Instrument is highly precise, simple, trouble-free and dependable.

Abbeon Supply Co, 179-15 Jamaica Ave, Jamaica 32, N.Y.

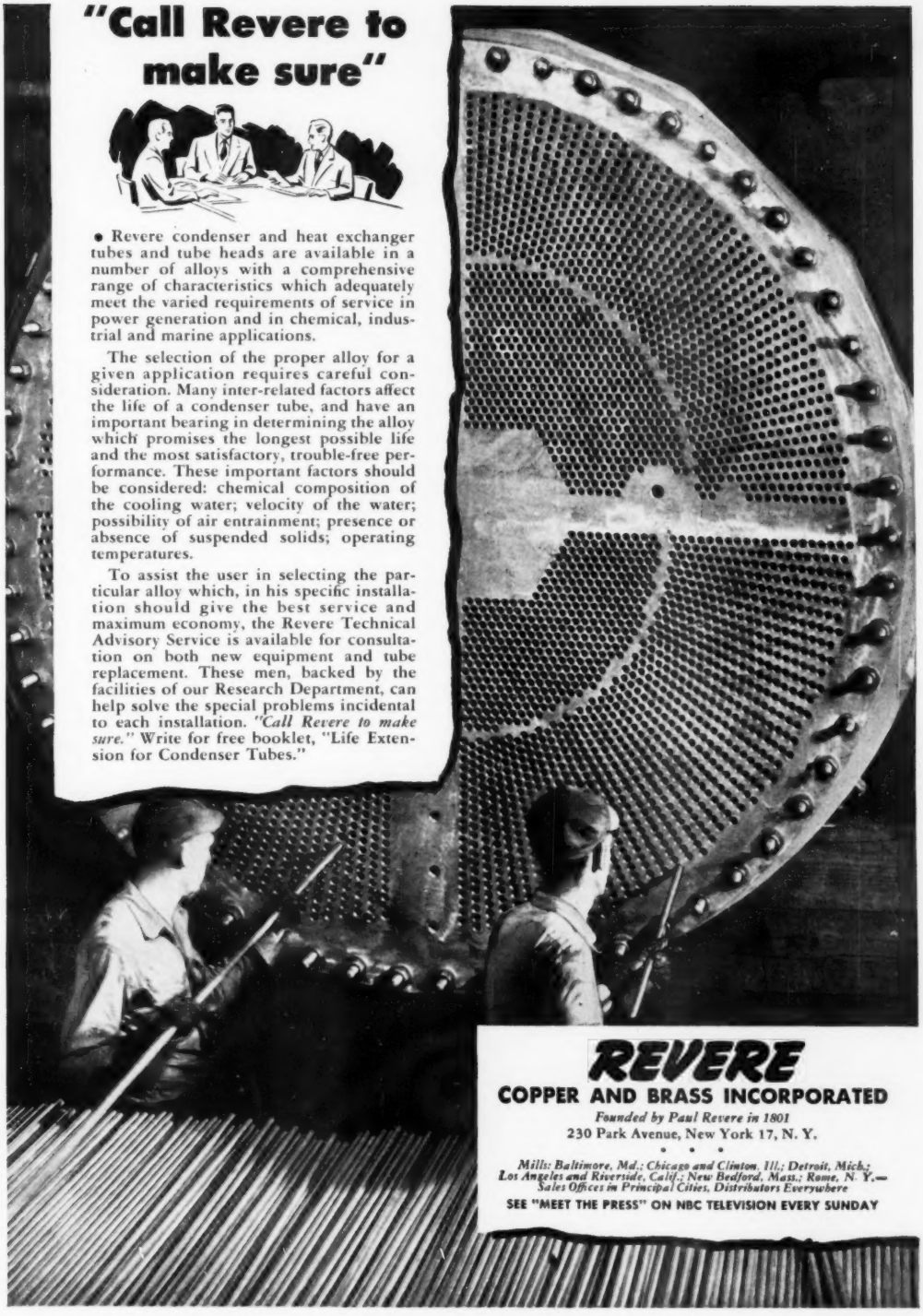
(*Continued on page 172*)

"Call Revere to make sure"

• Revere condenser and heat exchanger tubes and tube heads are available in a number of alloys with a comprehensive range of characteristics which adequately meet the varied requirements of service in power generation and in chemical, industrial and marine applications.

The selection of the proper alloy for a given application requires careful consideration. Many inter-related factors affect the life of a condenser tube, and have an important bearing in determining the alloy which promises the longest possible life and the most satisfactory, trouble-free performance. These important factors should be considered: chemical composition of the cooling water; velocity of the water; possibility of air entrainment; presence or absence of suspended solids; operating temperatures.

To assist the user in selecting the particular alloy which, in his specific installation should give the best service and maximum economy, the Revere Technical Advisory Service is available for consultation on both new equipment and tube replacement. These men, backed by the facilities of our Research Department, can help solve the special problems incidental to each installation. *"Call Revere to make sure."* Write for free booklet, "Life Extension for Condenser Tubes."



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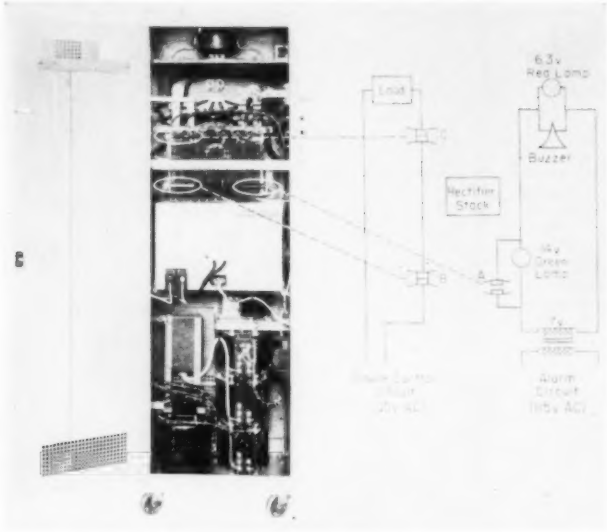
More EQUIPMENT NEWS

Begins on page 166



SENSITIVE THERMOSTATIC CONTROL

P539 • Alarm and shutoff actions of *Thermoswitch* allow selenium rectifier units to operate at maximum efficiency without danger of overheating. Stack temperature, which is controlling factor in life of selenium plates, results from combination of current load, ambient temperature, length of operation, and ventilation efficiency. Sensitivity of thermostatic control units (± 0.1 F) insures rapid functioning and safe operation at peak efficiency.

In fan-cooled Green rectifiers, one pair of thermostatic units (B) is placed directly under the stack, in line with the warm air blown from the plates by the fan. If the stack temperature exceeds 163 F, the switch contacts close, setting off the alarm (warning buzzer, red light on, green operating light off). If the stack temperature goes to 167 F, automatic controls cut power.

One or more additional *Thermoswitches* (designated C on drawing) are placed on upper side of stack in line with fan downdraft, and are normally set at about 130 F. If fan fails, or air supply is blocked, hot convection currents rising from stack will activate control and cut power.

Fenwal Inc, Ashland, Mass.

PNEUMATIC AND HYDRAULIC CABLE

P536 • *Armortube* cable is a flexible protected multi-tube transmission line for pneumatic and hydraulic control circuits. It is made of ¼ in. OD aluminum or copper tubing gathered in a slow continuous spiral similar to rope. Tube bundle is first wrapped in water-repellent insulating tape, then encased in heavy rust-resistant galvanized steel strip like that used for BX. Available in bundles of 4, 8 and 12 tubes, this cable transmits hydraulic control pressures up to 3000 psig and all ranges of pneumatic control pressures. Connections and takeoffs may be made in standard electrical junction boxes.

Bailey Meter Co, 1022 Ivanhoe Rd, Cleveland, Ohio

CHECK THESE TOO! . . .

Controllers, pneumatic ..... p 180
Regulator, temperature ..... p 182
Speed reducer, torque-arm ..... p 184
Transformer, variable ..... p 186
pH Meter ..... p 188
Transformer, instrument current ..... p 190
Cable clamp ..... p 192
Rheostat ..... p 194
Fittings, adjustable angle ..... p 194

PACKAGED BOILER

P534 • Self-contained, two-pass, scotch-marine-type boiler, the *Continental*, is available in sizes from about 350 to 17,500 lbs per hr (10-500 bhp). Burns heavy oil, light oil, gas or a combination at 80% efficiency or better. Steam output has less than 1% moisture content. Both front and back can be opened in 15-20 minutes for easy cleaning and servicing.

Boiler Engrg and Supply Co, Phoenixville, Pa.

WATER STRIPPER • P555

Simple, practical method of "breaking" emulsions to permit thorough dehydration of oil is claimed for new *Houdaille* water stripper for turbine oils. Reduces water content of oil to less than 0.1%. Also removes solid contamination, acid and other sludge-forming products of oxidation so oil need not be changed or discarded.

Honan-Crane Corp, Lebanon, Ind.

For more data on these items, use post cards, p 175. Identify request with P and number.

BOLT LOCK

P514 • Special patented bolt-locking device prevents bolt loosening under vibration or furnishes absolutely fixed locking for permanent structures. Device consists of a trip tooth with one or more notches. Either the nut or the bolt can carry the tooth and the other, the notches. Tooth and notch have a "saw-tooth" section.

Engineers Palazollo and Bruti, c/o General Secy, Italian Assn of Inventors, Rome, Italy.

(*Continued on page* 180)

STOP RUST! with RUST-OLEUM

Protects Tanks, Pipes, Girders, Metal Sash, Fences, Roofs and Buildings, Rail and Marine Facilities

BEAUTIFY AS YOU PROTECT—ALL COLORS, ALUMINUM AND WHITE!

RUST-OLEUM may be applied directly over *rusted surfaces without removing all the rust!* Just remove rust scale and loose particles with wire brush and sharp scrapers . . . then apply by brush, dip, or spray. Costly sandblasting and chemical pre-cleaning are not usually required. Easy as that to cut your maintenance costs. Specify **RUST-OLEUM** to your painting contractor or architect for *every rustable* metal surface! Prompt delivery from Industrial Distributor stocks in principal cities.

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FREE SURVEY: A **RUST-OLEUM** specialist will gladly survey your rust problems. He'll make specific tests and recommendations. No cost or obligation. See Sweets for complete catalog and nearest **RUST-OLEUM** distributor, or write for literature on your company letterhead.

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ILLCO-WAY "firsts" include manufacture of the first commercial two-bed De-ionizer . . . the first commercial mixed-bed De-ionizer . . . and the development and building of the first successful installations for the purification of such liquids as beet-juice and crude glycerol by ionXchange . . . In the power field, boiler feed water treatment by ILLCO-WAY ionXchange has long meant lower operating costs and increased operating efficiency. Installations in leading plants.

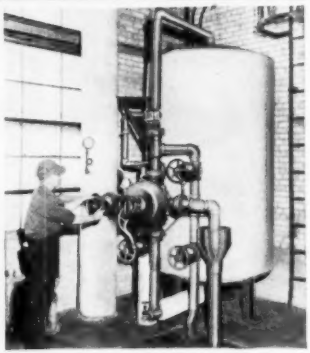
ILLCO-WAY

DE-IONIZING
DE-ALKALIZING
SOFTENING

For complete data, see Sweet's File, Power Plant

(Advertisement)

CASE HISTORY

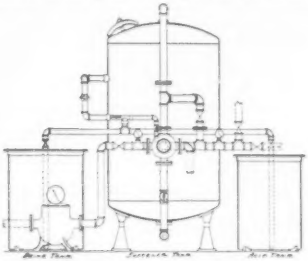


NATIONAL LOCK CO.

For the past three years, National Lock Co., Rockford, Illinois, has used an ILLCO-TEMP Softener to reduce the residual hardness in the effluent of the plant's hot-process unit.

The softener, pictured above, effects substantial reduction of soda ash normally used in hot process systems—thus decreasing caustic alkalinity and CO_2 in the return system, and reducing operating cost.

The unit, operating continuously at temperatures of 230° F. and above, was easily added to the plant's hot process softener.



ILLCO-TEMP SOFTENER

Illco-Way's hot-process (Zeolite softener) is designed for removal of residual hardness from the effluent of hot or cold lime-soda-units—without chemical after-treatment. The Illco-Temp Softener reduces, and in some instances eliminates, necessity of soda ash addition to the hot process units, thus decreasing operating costs, caustic alkalinity and CO_2 in return system. Easily added to lime-soda softeners, Illco-Temp Softeners operate economically and continuously at temperatures of 250° F. and above.

Illco-Way equipment, used in America's outstanding plants, includes the recently-developed Mixed-Bed De-ionizers, Hydrogen-Zeolite Units, Zeolite Softeners, Degasifiers, Filters.

CENTILIVRE BREWING

Duplex Illco-Way Softeners and filter at Centilivre Brewing Corp., Fort Wayne, Indiana, provide 100 gpm of soft water with controlled characteristics to eliminate corrosion. Final treated water used in the cooling system and bottle washers is non-corrosive and non-scale forming.

Preceding pages tell you what's new in plant equipment. Each item is numbered. For more info on any of them, write in their numbers here

New free catalogs and bulletins are listed beginning on back of this page. To order those you want, write in their item numbers here

Put 2¢ stamp on self-addressed card and mail it to us. We'll pass along your requests to the various companies, they'll send the info

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This month's FREE Literature

AIR CONDITIONING, HEATING REFRIGERATION AND VENTILATION

B1 **AIR DIFFUSER** — Adjustable, *Kno-Draft* outlets control direction and volume of air flow. 32-page bulletin K-20-A gives mounting heights, "throw" formulas, selection curves, dimensions, etc. W B Connor Engineering Corp, Shelter Rock Lane, Danbury, Conn.

B2 **VENTILATION AND EXHAUST FANS**—For industrial, commercial and residential purposes. 30-page catalog gives specifications, prices, dimensions on 30 types, 200 sizes. Chelsea Fan & Blower Co, Inc, Plainfield, N. J.

BOILERS AND AUXILIARIES

B3 **STEAM GENERATORS**—10 to 100 rated hp, self-contained units employ forced recirculation. 12-page booklet gives specifications, operation, installation photos. Clayton Mfg Co, El Monte, Calif.

B4 **WATER TUBE BOILERS** — Small to medium capacity. Underfeed, spreader stoker, oil or gas firing. 4-page bulletin has dimensions, diagrams. Dominion Bridge Co, Ltd, P O Box 280, Lachine, Que.

B5 **OIL BURNERS**—*Hev-E-Oil* unit handles any fuel oil not requiring heating during storage and pumping. 8-page catalog gives specifications, descriptions, photos. Cleaver-Brooks Co, 326 E Keefe Ave, Milwaukee 12, Wis.

B6 **FUEL DEHYDRATOR**—For diesel fuel, gasoline, kerosene and fuel oils. Capacities to 600 gpm. 2-page bulletin gives specifications. Bowser, Inc, Fort Wayne, Ind.

B7 **DUST FILTER**—Cloth type unit maintains uniform suction, reverses air flow to remove dust. 4-page bulletin 101 describes operation. W W Sly Mfg Co, 4700 Train Ave, Cleveland 2, Ohio.

B8 **REFRACTORIES**—Fire clay, high alumina, and silica brick, refractory specialties. 104-page pocket-sized catalog gives characteristics, recommended applications, estimating data. Mexico Refractories Co, Mexico, Mo.

MECHANICAL AND ELECTRICAL CONTROLS

B9 **COMBUSTION CONTROL**—For oil and gas-fired burners. Air-operated. 24-page bulletin 1023 shows 9 typical firing methods and 16 major control equipment components. Diagrams, installation data. Bailey Meter Co, 1050 Ivanhoe Rd, Cleveland 10, Ohio.

B10 **REGULATOR** — Direct-acting, finger-type regulator controls voltage, frequency and current. 12-page bulletin 505.00 shows circuits, applications. Electric Regulator Corp, 50 Day St, S Norwalk, Conn.

B11 **CONTROLLING PYROMETERS** — 9 temperature ranges from –200 to +3000 F. 4-page bulletin G-2 shows functions, applications. Assembly Products, Inc, Chagrin Falls 5, Ohio.

B12 **TEMPERATURE CONTROL** — *Pyr-O-Vane* unit features snap action, 1-, 2-, or 3-position electronic control. 4-page specification sheet 114 gives specifications, description, photos. Minneapolis-Honeywell Regulator Co, Brown Instrument Div, Station 40, Wayne & Windrim Aves, Philadelphia 44, Pa.

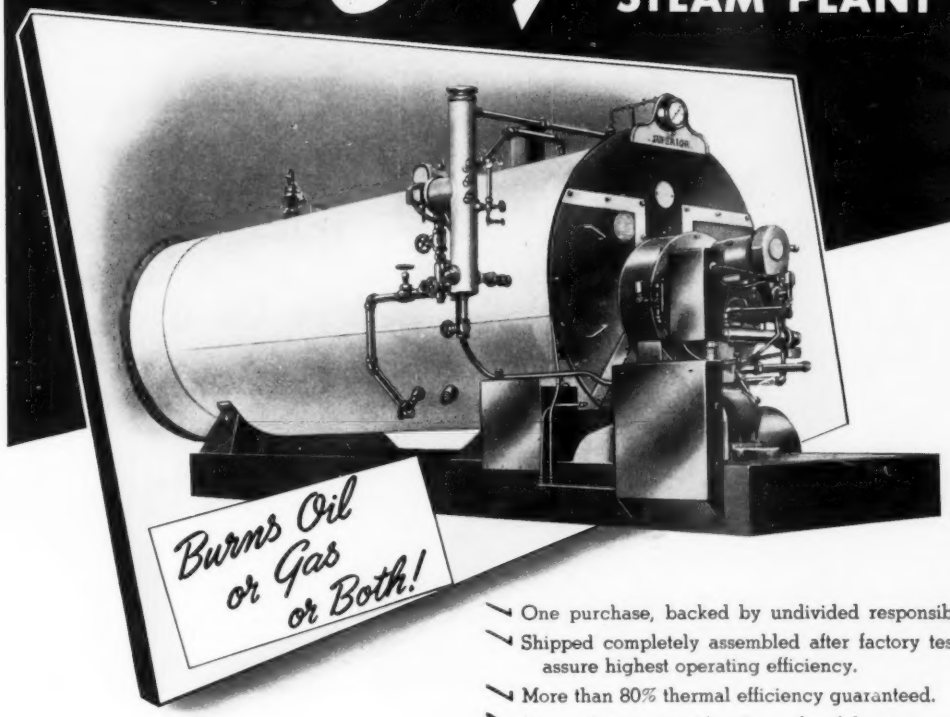
B13 **PUMP CONTROLS**—For 2 or more pumps in pressure-tank systems. 4-page bulletin 1510 explains *Duotrol* pressure and float control. Charts, diagrams. Automatic Control Co, 1005 University Ave, St. Paul 4, Minn.

ELECTRICAL EQUIPMENT

B14 **SWITCHGEAR** — Unitized, low voltage, metal-enclosed units for indoor and outdoor installations. 30-page booklet B-5282 outlines applications, describes types DB and DA drawout *De-Ion* circuit breakers and associated

(Continued on page 228)

HERE'S YOUR *Complete* STEAM PLANT



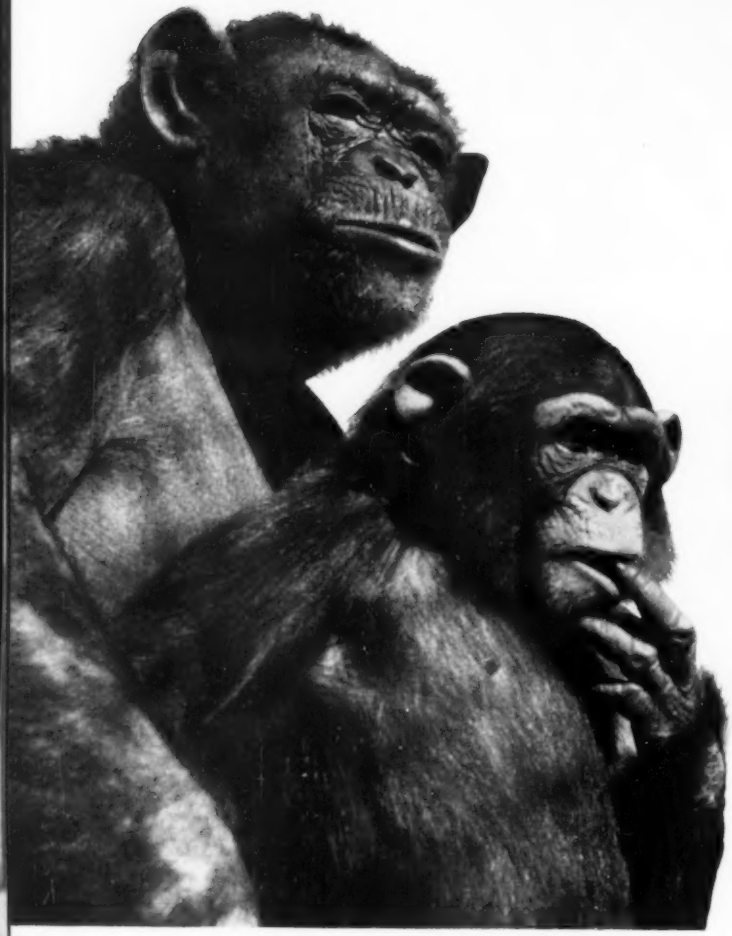
- One purchase, backed by undivided responsibility.
- Shipped completely assembled after factory tests to assure highest operating efficiency.
- More than 80% thermal efficiency guaranteed.
- 4-pass design provides 5 sq. ft. of heating surface per b.h.p.
- Induced draft fans which are built-in eliminate the need of an expensive chimney.
- Simple installation requires no special foundation.
- Clean, quiet operation.
- Heavy-duty, rugged construction assures long-lived dependability.
- Burner equipment to suit your fuel: gas, oil or both.
- 18 sizes from 20 to 600 b.h.p. for pressures up to 250 p.s.i., or for hot water heating.
- For complete details, write today for catalog 401.

SUPERIOR STEAM GENERATORS

SUPERIOR COMBUSTION INDUSTRIES, Inc.

Factory: Emmaus, Pa.

Executive Offices: Times Building, Times Square, New York 18, N. Y.



Guess I Forgot To Oil It

YOU SURE DID, Jocko, and there goes a week's priority defense production, all shot to hell. But we chiefs can't hold a guy like Jocko responsible—not if we have all our marbles.

That's why the trend today is to put the brightest mechanic in charge of lubrication and not trust it to a grease monkey. Why? One little slip, and *zingo*, the whole plant can be knocked out—at least temporarily.

So smart engineers in larger plants see that this key spot is filled by a man who keeps on his toes about lubrication practices. Instead of monkeying around, he keeps log sheets of all oil and grease changes, watches supplies so they're not contaminated, and so on. In smaller plants, engineers assign the oil can to a well paid mechanic who at least knows how to overhaul a bearing. A guy like that makes each drop of oil strike home—and he never misses squirting that drop to the right place, at the right time.

If one bearing failure can be so expensive, what cheaper insurance can a chief buy against breakdowns and costly wear than smart, well paid help?

Monkey business and lubrication don't mix. It's either one or the other, but never both.

George Edwards

Engineer

Just in case...

Just a little fever, but you called in the doctor—just in case. Perhaps all he did was write out a prescription for some pink pills, but if it had been serious, it was nice to know Doc was there. What the doctor does is important—*but what he knows how to do is more important—just in case!*

An experienced maintenance cleaning service company is somewhat like a good doctor. What they do on a particular job is important—but, even more important, is what they know how to do—just in case. A great many jobs are routine and can be handled as such. It's those complications that can cause the trouble.

Dowell pioneered the service use of chemicals to clean heat exchange equipment. Thousands of successful jobs have led to the improvement of techniques, materials and equipment . . . and the expansion of cleaning methods to many new applications. Over a decade of working in all types of plants—from coast to coast—has provided the background of experience that is always on any job . . . just in case.

The next time you have a maintenance cleaning problem, call Dowell. Whether it's a boiler or a process tower, a water line or a water well, Dowell offers the experience and dependability that are your assurance of a good job.

Dowell Incorporated

TULSA 1, OKLAHOMA

90 STRATEGICALLY LOCATED OFFICES
TO SERVE ALL INDUSTRY WITH

★ *Maintenance cleaning service for industrial heat exchange equipment.*
★ *Chemical services for oil, gas and water wells.*

DOWELL

A Service Subsidiary of
THE DOW CHEMICAL COMPANY

Pumping Problems?

call your Deming Distributor

Countless thousands of pumping problems are solved quickly and economically by Deming Distributors.

Their efficient, multiple services are within easy reach of you . . . ready for action on short notice.

The extensive Deming line makes it possible to "pinpoint" the right pumps for specified needs.

So complete is the range of types, sizes and capacities of Deming Pumps that some plants standardize on Deming units for all pumping operations.

Bulletins are readily available to you on a wide diversity of Deming Pumps... horizontal and vertical centrifugal types, vertical turbine types, condensation return units, boiler feed pumps, sump pumps, complete water systems and other units.

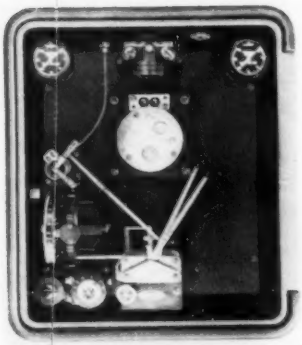
When you face a pumping problem, call in your Deming Distributor. If you don't know where to reach him, ask us.

THE DEMING COMPANY
547 Broadway • Salem, Ohio

DEMING *Industrial* PUMPS

More EQUIPMENT NEWS

Begins on page 166



PNEUMATIC CONTROLLERS

P503 • These modern instruments are designed for precise control of pressure, temperature, liquid level or rate-of-flow. Types of control available include proportional, proportional-reset, on-off and differential-gap. Supplementary types are pneumatic-set, time cycle, differential and manual. Pressure ranges go up to 5000 psi, temperatures from −40 to 1000 F, flow between 0-20 and 0-200 in. H_2O, liquid level up to 50 ft H_2O. Construction is sturdy, appearance attractive.

Mason-Neilan Regular Co, 1190 Adams St, Boston 24, Mass.

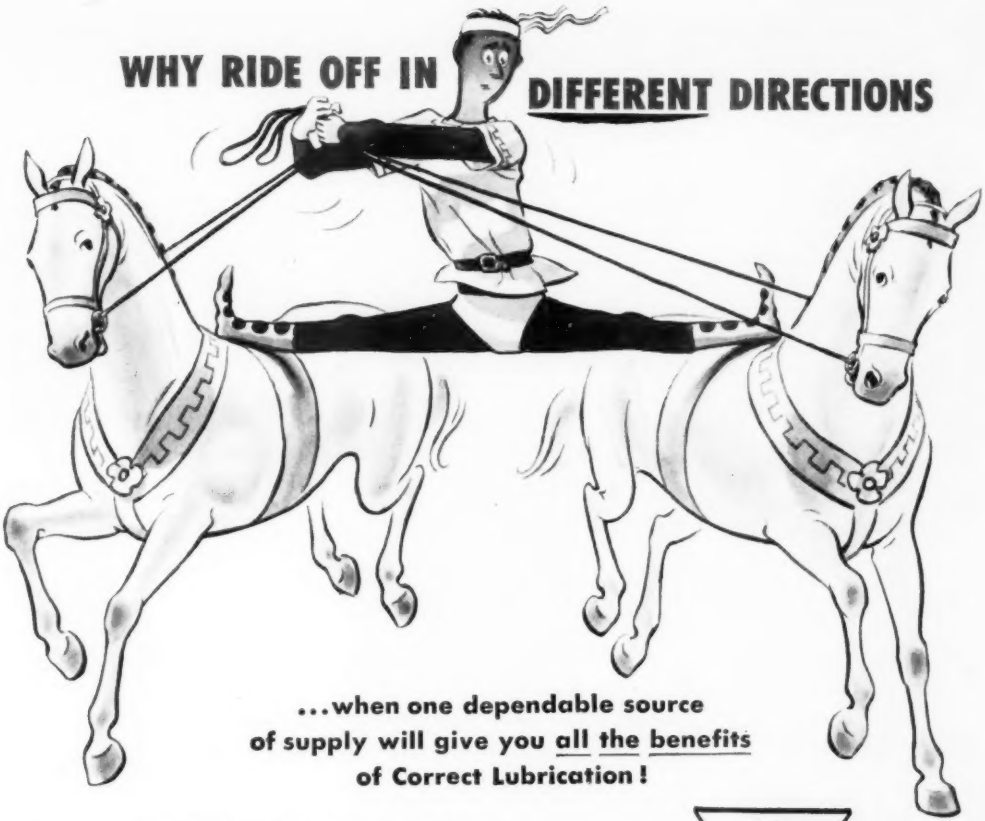
For more data on these items, use post cards, p175. Identify request with P and number.

SMALL AIR COMPRESSORS

P557 • Units range from ½ to 5 hp, single and two-stage. Models include: bare compressor with flywheel on base with electric motor, on horizontal receiver with motor or gasoline engine, on vertical receiver, on horizontal receiver.

Features of receiver-mounted units include: safety and outlet valves, pressure gage and switch in a compact unit, large

WHY RIDE OFF IN DIFFERENT DIRECTIONS



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The questionable benefits of splitting your oil business are far outweighed by the *positive* benefits of buying all your lubricants from one reputable supplier.

For example—your decision to buy from Socony-Vacuum brings you an analysis of your plant lubrication, recommendations to improve lubrication efficiency, continuous engineering service and proof of benefits.

Designed for *your* machines, this program of Correct Lubrication pays off in greater efficiency, less power loss, lower maintenance and over-all lubrication costs.

Why not call your Socony-Vacuum representative *today?*

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Correct Lubrication

WORLD'S GREATEST LUBRICATION KNOWLEDGE AND ENGINEERING SERVICE

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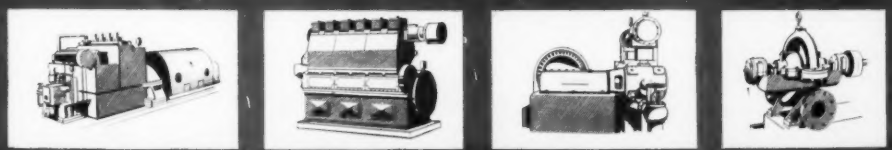

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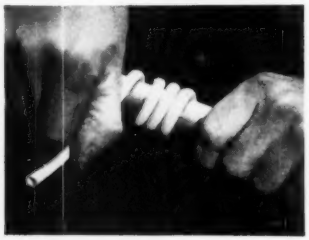
CUT FUEL COSTS
this Quick Easy Way!
In plants the country over, simply replacing worn out, leaky traps is enabling operators to maintain full heat requirements on reduced amounts of fuel. For example: an internationally famous maker of farm implements, after installing Hoffman traps on radiators, recorded a drop of 35% in steam consumption for heating, with corresponding fuel savings. Hoffman Steam Traps make any heating plant modernization a genuine success. Not only are they recognized as highly efficient units, but they have features which amazingly prolong service life. They are so constructed that all parts subject to wear can be easily and inexpensively renewed—no need to junk an entire unit because of a worn seat. All together, these traps are a rare combination of sound design and excellent material, assembled with genuine pride in good workmanship. Your customers will welcome your suggestions for modernizing their heating plants.
No. 8H and 9H
HIGH PRESSURE
Pressure Range 0 to 125 lbs. Cap. from 235 to 1250 lbs. con. p.h. No. 8H in angle, R.H., L.H. and straightway patterns. No. 9H in angle pattern only.
Nos. 8 and 9
MEDIUM PRESSURE
Pressure Range 0 to 50 lbs. Cap. from 100 to 850 lbs. con. p.h. No. 8 in angle, R.H., L.H. and straightway patterns. No. 9 in angle pattern only.
No. 17C
LOW PRESSURE
Pressure Range 0 to 15 lbs. Cap. 200 sq. ft. E.D.R. Angle, vertical and vertical patterns.
Removable thermal units are a distinguishing feature of Hoffman Traps, greatly simplifying clean-out and inspection work.
HOFFMAN Steam TRAPS
HOFFMAN SPECIALTY COMPANY, Dept. P-5, 1001 York St., Indianapolis 7, Ind.
Famous for HOFFMAN VALVES, TRAPS, VACUUM AND CONDENSATION PUMPS, FORCED HOT WATER HEATING SYSTEMS Sold by leading Wholesalers of Heating and Plumbing Equipment
THREE TYPICAL APPLICATIONS OF HOFFMAN THERMOSTATIC TRAPS
FOR END OF MAIN

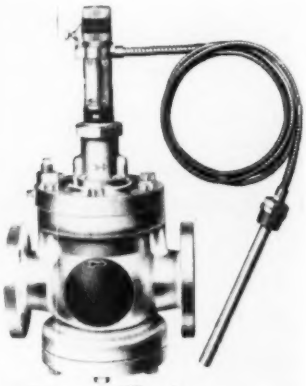
intake muffler with air filter, wafer-type valves, V-belt drive, controlled lubrication and cooling fins for compressor.
Schramm Inc, West Chester, Pa.



ELECTRICAL TUBING

P531 • Silicone rubber coated fiberglas tubing is a class H product, and has exceptional flexibility and heat endurance. Will withstand exposure of 200 hrs at 200 C without embrittlement.
Irvington Varnish & Insulator Co, 6 Argyle Terrace, Irvington 11, N.J.

For more data on these items, use post cards, p 175. Identify request with P and number.



TEMPERATURE REGULATOR • P558

Designated as Type 1005, temperature regulator can be easily taken apart for relapping and cleaning in the field. It also has visual finger-tip dial control; built-in strainers to protect pilot and main valves; stainless steel seats and discs; internal porting to eliminate external damage and minimize maintenance.

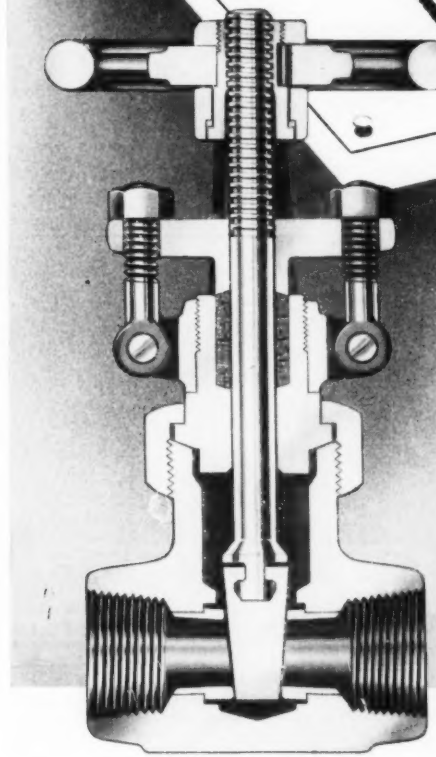
Control accuracy of ± 1 F is obtained by a fully balanced, single-seated pilot operating on a vapor flash principle. 99% of the power to position the valve is taken directly from the steam; and only 1% from vapor expansion in the thermostatic system.

Type 1005 regulator is self-contained and

Many Specifications

but they are *all* met by

Chapman List 960



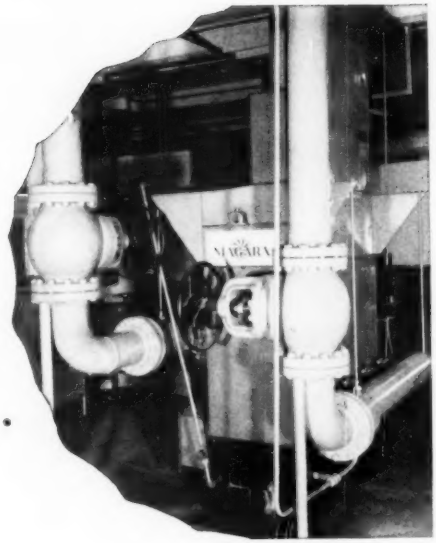
For range of "availability for duty," you can't beat this small gate valve with the forged steel body and yoke. And it handles *every* job with the same Chapman top standard of performance. Here's why:

Any *extra stress* more than meets its match in the *extra strength* of the stem and wedge-gate connection. Added life for seat rings and gate faces is obtained by using super-hardened stainless steel. Seizing or galling of seating surfaces is prevented by gates (with certain types of trim) super-hardened by Chapman's *Malcomizing* process to at least 800 Brinell.

You can get List 960 in sizes from ½" to 2", and equipped with rising stem — either with yoke as shown above, or with inside screw. Bonnet joints are gasketed or metal-to-metal. Pressure range: 2,000 lb. at 100°F.—380 lb. at 1,000°F. For higher pressures, specify List 990. Catalog No. 10 is yours for the asking. Write to The Chapman Valve Manufacturing Company, Indian Orchard, Mass.

The CHAPMAN VALVE
Manufacturing Company
INDIAN ORCHARD, MASSACHUSETTS

How to get drier or cooler gases . . .



NIAGARA AERO AFTER COOLER cools a compressed gas, or air, below the temperature of the surrounding atmosphere, thus preventing the condensation of moisture in your lines. The gas will contain only half of the moisture left in it by conventional methods. Even drier gas can be produced if you require it.

In working with controlled atmospheres of inert gases to prevent undesired reactions, this dryness of the gas at low cost is a great advantage. The cost of the Niagara method is low because it uses evaporative cooling, saving 95% of the cost of cooling water (and its piping and pumping). This direct saving of cost pays for the Niagara cooler in less than two years.

If you use compressed air to operate tools or pneumatic equipment you save much in water and oil damage to tools and equipment, and in water damage to materials by using the Niagara Aero After Cooler.

Write for a bulletin, or ask nearest Niagara Field Engineer if you have a problem involving the industrial use of air.

NIAGARA BLOWER COMPANY

Over 35 Years' Service in Industrial Air Engineering

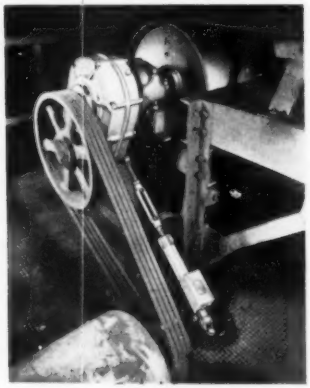
Dept. P, 405 Lexington Ave. New York 17, N. Y.

Experienced Field Engineers in Principal Cities of U. S. and Canada

More EQUIPMENT NEWS

Begins on page 166

pilot operated in sizes 2- through 4-in. It is available with 125 or 250 lb ASA flanges for steam pressures from 10 to 150 psig and for temperatures from 30 to 325 F. Adjustment range is 60 F.
Farris Stacon Corp, 627 Commercial Ave, Palisades Park, N. J.



TORQUE-ARM SPEED REDUCER

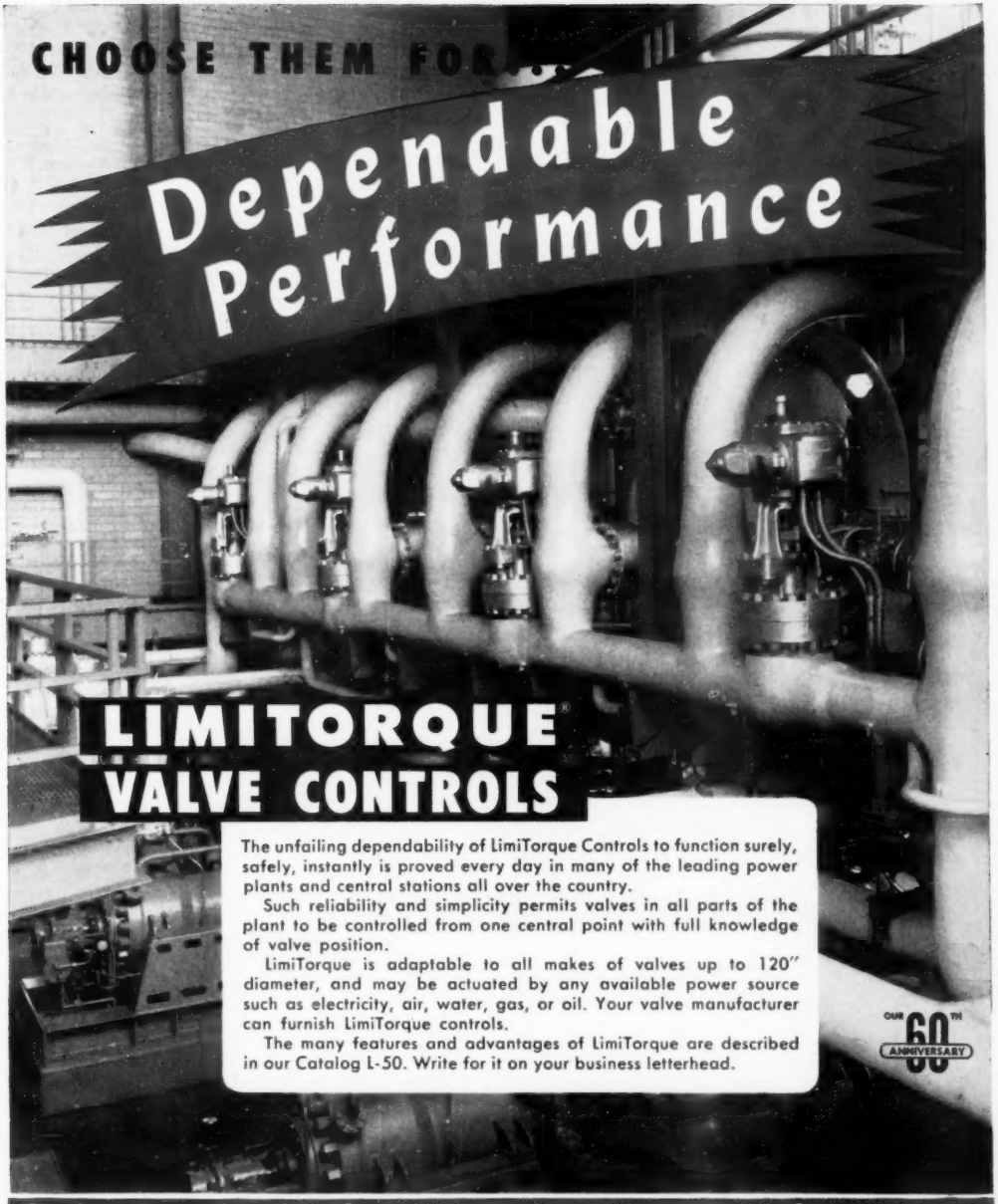
P522 • Double-reduction shaft-mounted speed reducer, No 7, has capacity to 43 hp and output speeds from 12 to 110 rpm. Reducer is anchored with a torque-arm that fastens to any fixed object. A turnbuckle adjusts belt tension. No foundation and no flexible couplings are needed.
Dodge Mfg Corp, Mishawaka, Ind.

For more data on these items, use post cards, p175. Identify request with P and number.

OPERATOR'S DESK

P528 • Console desk allows one operator to get up to 96 temperature readings from as many process points. Desk is 60-in. wide executive type arranged with cutouts for electronic precision indicator and key-switch banks or push-button assemblies. It can be tied in with any single, multiple or colorgraphic panel board.

Desk with push-buttons (non-locking only) is for maximum of 96 thermocouple points, indicated only or recorded normal-


CHOOSE THEM FOR
Dependable Performance
LIMITORQUE®
VALVE CONTROLS
The unfailing dependability of LimiTorque Controls to function surely, safely, instantly is proved every day in many of the leading power plants and central stations all over the country.
Such reliability and simplicity permits valves in all parts of the plant to be controlled from one central point with full knowledge of valve position.
LimiTorque is adaptable to all makes of valves up to 120" diameter, and may be actuated by any available power source such as electricity, air, water, gas, or oil. Your valve manufacturer can furnish LimiTorque controls.
The many features and advantages of LimiTorque are described in our Catalog L-50. Write for it on your business letterhead.
OUR 60TH ANNIVERSARY
60

Philadelphia Gear Works, INC.

ERIE AVE. AND G ST., PHILADELPHIA 34, PA.

NEW YORK • PITTSBURGH • CHICAGO • HOUSTON • LYNCHBURG, VA.

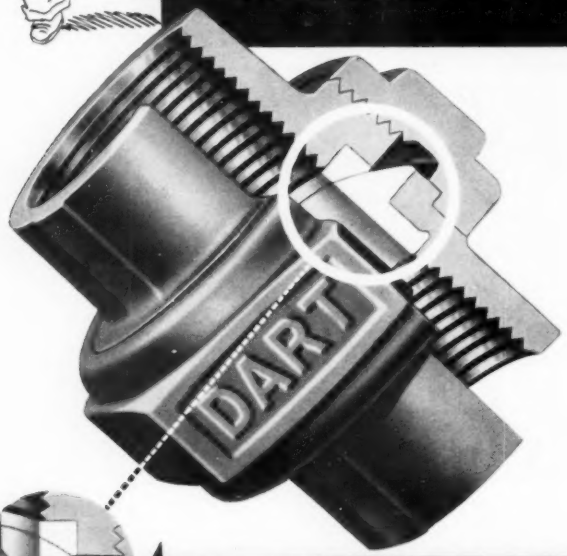
Industrial Gears and Speed Reducers
LimiTorque Valve Controls

You'll Avoid "Jam Sessions"

with

DARTS

...the Union that gives a Drop-Tight Closure!



This True Ball Joint Makes the Difference

DART UNIONS don't get tight, stay tight because of an ordinary "jammed" joint. Their tightness comes from a precision-ground, bronze-to-bronze ball joint that comes apart readily and remakes repeatedly — as tight as when new.

Both seats are non-corrosive bronze for top protection against pitting and corrosion. Nuts and both ends are high test, air refined malleable iron — practically indestructible in use or abuse.

Remember, the *extra* work life of a Dart is money in your pocket! Darts can be installed and reinstalled, time after time, with absolute assurance of tightness.

DART UNION COMPANY
Providence 5, Rhode Island
The Fairbanks Co. — Distributors
Boston New York Pittsburgh

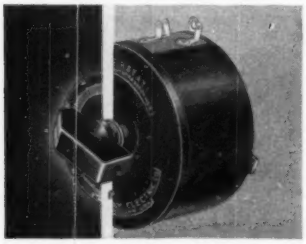
DART
UNIONS

More EQUIPMENT NEWS

Begins on page 166

ly, indicated optionally. Desk with key switches (locking or non-locking) is for maximum of 72 indicated thermocouple points.

Minneapolis-Honeywell Regulator Co, Brown Instruments Div, Wayne & Windrim Ave, Philadelphia 44, Pa.



VARIABLE TRANSFORMER

P541 • The *Powerstat Type 10* variable transformer is rated 120-v, 60-cycles, single phase input with an output of 0-120/132-v, 1.25 amp, 150/165 va, and is designed for 50, 100, and 150w applications. It is made for single hole mounting and has a projection on the base for keying to the panel. Compactness permits mounting under 3-in. chassis.

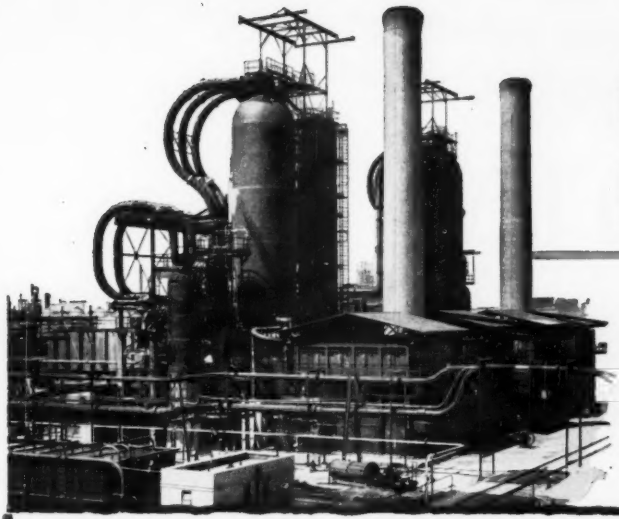
The Superior Electric Co, Bristol, Conn.

For more data on these items, use post cards, p175. Identify request with P and number.

PORTABLE VACUUM TUBE VOLT-OHM-MILLIAMMETER

P538 • This self-contained, universal test instrument, *Model 601*, is battery operated and needs no external source of power. It has 6 dc voltage ranges from 3- to 1,200-v full scale, 13 megohm input impedance; 5 ac voltage ranges from 3- to 300-v full range, 6 megohm input impedance; 6 ohm ranges from 1- to 100-megohms; and 6 current ranges from 3- to 1,200 milliamps.

Meter can be used on grounded or symmetrical circuits, and either positive or



Carey INSULATION is at work for GULF . . .

keeping process and steam lines operating at lowest cost

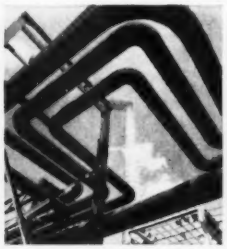
Refinery men demand *quality* insulation for processing operations. It's needed to keep fluids at constant temperatures. Helps cut fuel waste.

Since 1929, Carey insulation has been in continuous service at the Port Arthur, Texas plant of the Gulf Oil Corporation. Over the years, it has proven itself equal to the punishing strains of vibration and rapid expansion and contraction of equipment encountered in refinery operations . . . while guarding against heat loss, holding the line on costs!

In *your* plant, you'll find dozens of applications where a Carey insulation material can conserve heat, save fuel. Carey's complete line of high and low temperature insulations includes blocks, blankets, pipe wrapping and jackets, cements and new Super-Light 85% magnesia in precision-sized blocks and nesting "O.D." pipe coverings that are easy and economical to apply.

Whether your problem is one of insulating "straight runs" or complicated shapes, a Carey Industrial Sales Engineer can show you why Carey insulation is best for the job. He'll gladly furnish you with complete technical and application data. No obligation to you. Telephone, wire or write our nearest office today.

Another Carey product—Careystone Corrugated Asbestos-Cement Roofing and Siding—protects Gulf Oil Corporation's warehouse at Port Arthur, Texas. This material is absolutely impervious to corrosion, rust, rot, decay; never requires painting or preservative treatment; is virtually maintenance-free!



"Worm's eye" view of live and exhaust steam lines insulated with Carey materials. Besides the usual hazards of expansion, contraction and vibration, this Carey installation stands up under the extremely hot, humid weather of the Gulf area.

Carey insulation materials have weathered 23 years of continuous service on the fractionating tower and vapor lines of these atmospheric and vacuum stills at Gulf Oil Corporation's Port Arthur, Texas plant.

Write Today for Your FREE Copy

of "Industrial Insulation." Tells all about Carey insulations, and how to select and use them. A copy is yours for the asking.

FROM THE HOUSE OF CAREY—

Industrial Insulations • Careystone Corrugated Roofing and Siding • Built-up Roofing • Careyduct • Asphalt Plank • Asphalt Paints and Coatings • Industrial Flooring • Other Famous Products for Industry Since 1873

Carey

The Philip Carey Mfg. Company, Lockland, Cincinnati 15, Ohio • In Canada: The Philip Carey Co., Ltd., 277 Duke St., Montreal 3, P. Q.

FOR HEATING, POWER AND INDUSTRIAL PROCESS STEAM

KEWANEE

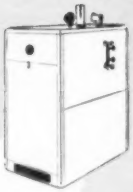
STEEL BOILERS

FOR HEATING

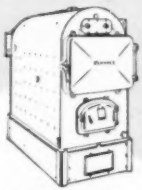
For more than three-quarters of a century the name KEWANEE has stood for the best in boilers . . . whether high or low pressure . . . for Heating, Power or Industrial Process Steam.

In sizes and types to produce 77,000 to 10,200,000 Btu hourly for low pressure heating . . . or develop from 7 to 304 horsepower . . . there is a Kewanee just right for the purpose.

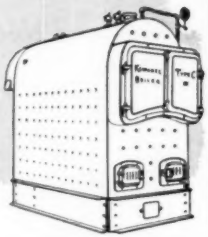
COTTAGE BOILER



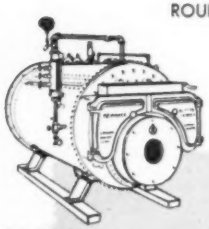
Jacketed ROUND "R"



SQUARE HEAT for medium size buildings

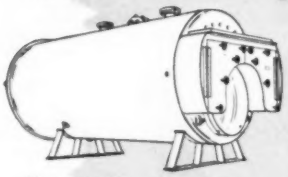


TYPE "C" for large buildings



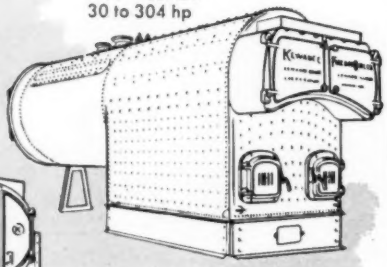
SCOTTIE JR. 7 to 36 hp

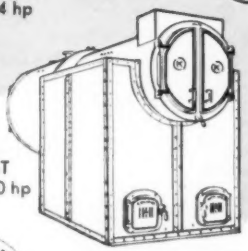
FOR POWER



H M SCOT 52 to 304 hp

"500" SERIES 30 to 304 hp





HI-TEST 60 to 180 hp

KEWANEE BOILER CORPORATION
KEWANEE, ILLINOIS
Division of American Radiator & Standard Sanitary Corporation

KEWANEE ON THE STAGE
NATL PLBG & HTG EXPOSITION ATLANTIC CITY JUNE 2-5

KEWANEE BOILERS

Serving home and industry

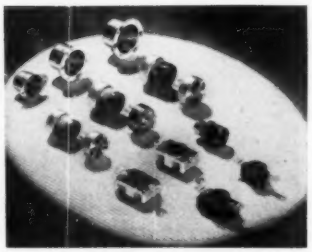
More EQUIPMENT NEWS

Begins on page 166

negative dc voltages can be measured without switching leads. It also has a "signal tracing" test probe for measuring dynamic voltages in signal carrying circuits without interference to circuit action.

Battery life is better than 100 hrs of normal operation (4 hr per day). Its size is 10x6⅜x5⅝ in.

American Chronoscope Corp, 316 W First St, Mount Vernon, N.Y.

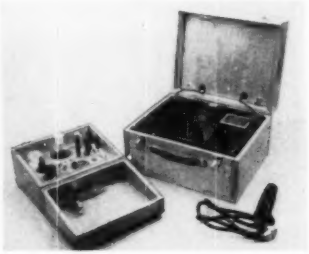


LOCKING CURRENT CARRIER

P526 • *Hart-Lock* connection locks in position by twist of the cap to prevent accidental disconnects. For long assembly lines, overhead connections, or wherever cords are subject to pull. Line includes assortment of 20 amp, 2-wire, 3-wire and 4-wire connector bodies; motor plug, flush receptacles; and regular, rubber and armored caps with or without cord grips.

Arrow-Hart & Hegeman Electric Co, 100 Hawthorn St, Hartford, Conn.

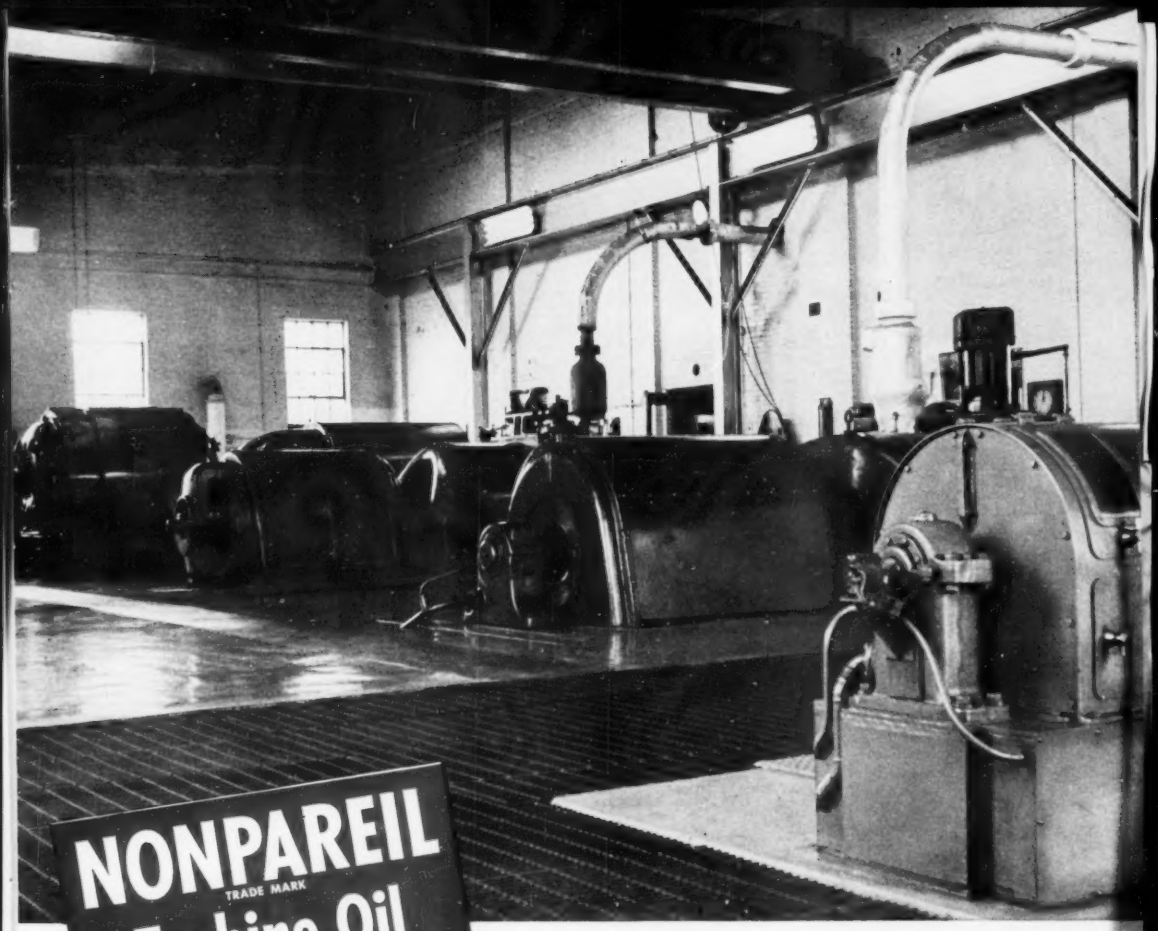
For more data on these items, use post cards, p175. Identify request with P and number.



pH METER • P539

Universal pH meter is designed for all pH and rH work, for potentiometric titrations and for oxidation-reduction-potential investigations. For laboratory research and industrial testing purposes it provides a measuring accuracy of 0.01 pH or 0.5 mv, a range of 0-14.15 pH and 0-1415 mv, absolutely currentless measuring with no phenomena of polarization, zero indication by cathode ray tube. Can be used with glass, quinhydrone, hydrogen and platina electrodes and is directly calibrated for the first three.

The pH meter is supplied with the new,



Completes first 20 years on this job

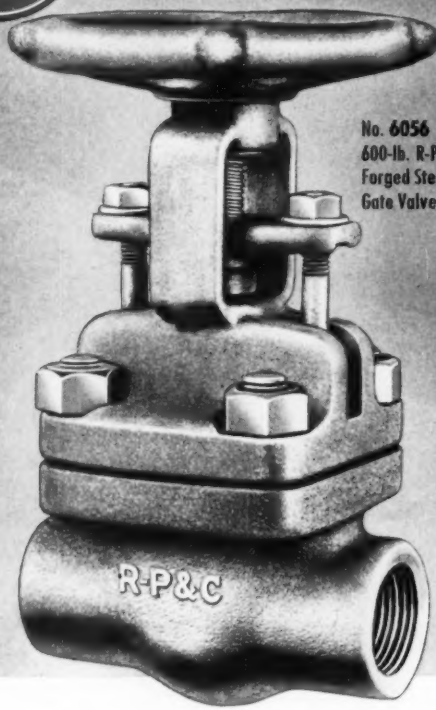
AFTER TWENTY YEARS of service in the first turbine installed by a midwest power plant, the original fill of NONPAREIL Turbine Oil is still on the job. There's no retirement in sight for this veteran.

During this time the acidity number has never exceeded 0.10 mg. KOH/gm. Removal of the oil for treating or for cleaning of the turbine lubricating system has never been necessary, and make-up requirements have remained at a minimum. That's low-cost, trouble-free turbine lubrication . . . the same kind of lubrication these plant operators are getting in three newer turbines with NONPAREIL.

There's no time limit on results like these when you use NONPAREIL. It's guaranteed in writing to last as long as the turbine itself, and the neutralization number is guaranteed never to exceed 0.15 mg. KOH/gm. For low-cost, trouble-free lubrication of *your* turbine, ask your Standard Oil lubrication specialist to explain the advantages of NONPAREIL. Let him show you operating records covering periods of continuous service well over twenty years. Call your nearest Standard Oil Company office. Or write: Standard Oil Company (Indiana), 910 South Michigan Ave., Chicago 80, Ill.

STANDARD OIL COMPANY STANDARD *(Indiana)*

an ACCO product



Premium Quality Features

● Body, bonnet, yoke, wedge, and hand-wheel of this sturdy R-P&C Gate Valve are forged steel. Wedge is heat-treated. Seating surfaces are smoothly ground and chromium plated for near diamond hardness. Stainless steel swinging gland eyebolts and nuts won't corrode or freeze. Furnished in ¼" to 2" sizes. Screwed, flanged, or welded end.

It's a premium quality valve but NOT premium priced. See your R-P&C distributor or write nearest R-P&C district office.

ACCO

R-P&C VALVE DIVISION
AMERICAN CHAIN & CABLE

Reading, Pa., Atlanta, Baltimore, Boston, Chicago, Denver, Detroit, Houston, New York, Philadelphia, Pittsburgh, San Francisco, Bridgeport, Conn.

TRADE MARK

R-P&C valves

More EQUIPMENT NEWS

Begins on page 166

removable Philips calomel and glass electrode and is provided with controls which correct for temperature variations and for asymmetric potentials. Unit has built-in cadmium standard cell and flexible cable with a plug for connection to 60 cycle ac power supply circuit. Transformer taps can be changed to accommodate voltages of 110, 125, 145, 200, 220 and 245.

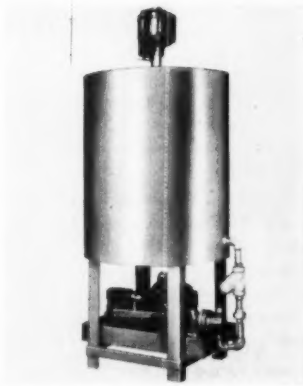
North American Philips Co, Inc, 750 South Fulton Ave, Mt. Vernon, N. Y.

INSTRUMENT CURRENT TRANSFORMER

P523 • Model 321 series *Donut* instrument current transformer is rated 2.5 va (NEMA Standards Capacity X), gives 1.2% accuracy at full rated capacity, operates in 25- to 133-cycle range, and is insulated for use on 2400-v rms service. Leads are 2 ft long and terminate with ¼ in. solder lugs. Leads are color coded for phasing.

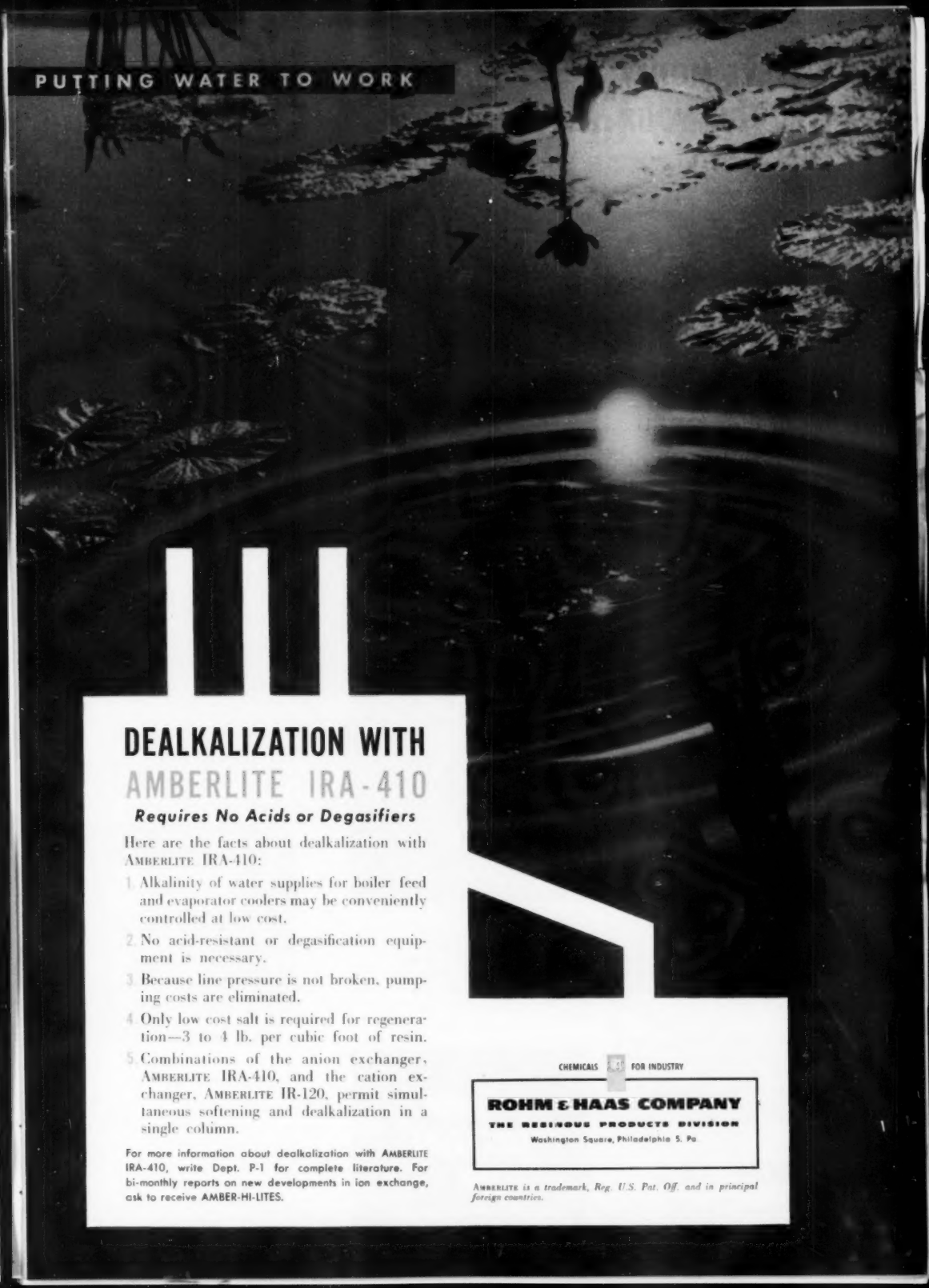
Associated Research, Inc, 3796 W Belmont Ave, Chicago 18, Ill.

For more data on these items, use post cards, p175. Identify request with P and number.



PACKAGED CHEMICAL FEED UNIT

P502 • This self-contained extra-heavy *Baco* unit offers high-pressure controlled feed at low cost. Chemical reservoir tank is welded steel available in 50- or 100-gal



DEALKALIZATION WITH AMBERLITE IRA-410

Requires No Acids or Degasifiers

Here are the facts about dealkalization with AMBERLITE IRA-410:

1. Alkalinity of water supplies for boiler feed and evaporator coolers may be conveniently controlled at low cost.
2. No acid-resistant or degasification equipment is necessary.
3. Because line pressure is not broken, pumping costs are eliminated.
4. Only low cost salt is required for regeneration—3 to 4 lb. per cubic foot of resin.
5. Combinations of the anion exchanger, AMBERLITE IRA-410, and the cation exchanger, AMBERLITE IR-120, permit simultaneous softening and dealkalization in a single column.

For more information about dealkalization with AMBERLITE IRA-410, write Dept. P-1 for complete literature. For bi-monthly reports on new developments in ion exchange, ask to receive AMBER-HI-LITES.

CHEMICALS FOR INDUSTRY

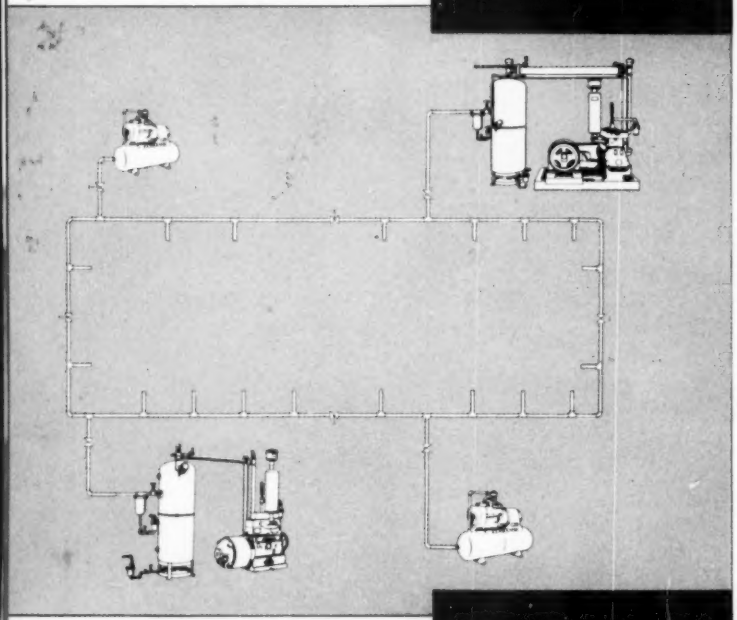
ROHM & HAAS COMPANY

THE RESINOUS PRODUCTS DIVISION

Washington Square, Philadelphia 5, Pa.

AMBERLITE is a trademark, Reg. U.S. Pat. Off. and in principal foreign countries.

HOW TO SAVE MONEY ON YOUR... AIR COMPRESSOR INSTALLATION



The perfect, money-saving, "inside-the-plant" air compressor installation is the Schramm unit system . . . whereby, in a minimum of space, you install one, two, three or more Schramm air compressors, according to your air needs, and operate them singly, or separately, as the load requires. Here is how such an installation saves you money:

1. Low In Initial Cost. No foundation cost, cuts by half the installation price. Can be transported into the plant on standard material handling equipment, set in place, grouted, bolted down, ready for use in matter of hours!

SCHRAMM UNIT SYSTEM

2. Low in operating cost. The losses when operating a large compressor at light load are very great. On the other hand, the vertical compressors in unit system can be equipped with automatic start and stop control, set at proper pressure ranges, so as to regulate the air output according to load demand. Unit system installations allow you to use one, or as many of the compressors as you need.

3. Low in maintenance cost. The unit system allows you, when one of the compressors is shut down for minor repairs, to continue operating the other compressors without affecting the overall capacity of the plant to any appreciable extent. *For full details write us today.*

SCHRAMM, INC.

The Compressor People

WEST CHESTER • PENNSYLVANIA

SCHRAMM INDUSTRIAL AIR COMPRESSORS

More EQUIPMENT NEWS

Begins on page 166

capacity. Pump can be designed for various rates of feed at different pressures. Motor-driven agitator assures completely mixed fluids at all times. Strainer between pump suction and tank is stainless steel. Duplex-pump model with divided tank also available. Both types of units supplied complete with all necessary piping and are ready for connection.

The Bird-Archer Co, 4337 N American St, Philadelphia 40, Pa.

CABLE CLAMP

P532 • Quarter-bend cable clamp, the *Sky-Tie*, is suited for anchoring bus-drop cable without conduit. Two identical pieces form the device, joined by two heavy bolts. A spring that fits onto the clamp tangentially to its bend ties back to a structural member and absorbs vibration or shock to cable.

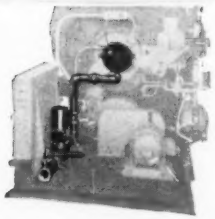
Adalet Mfg Co, 14300 Lorain Ave, Cleveland 11, Ohio

For more data on these items, use post cards, p 175. Identify request with P and number.

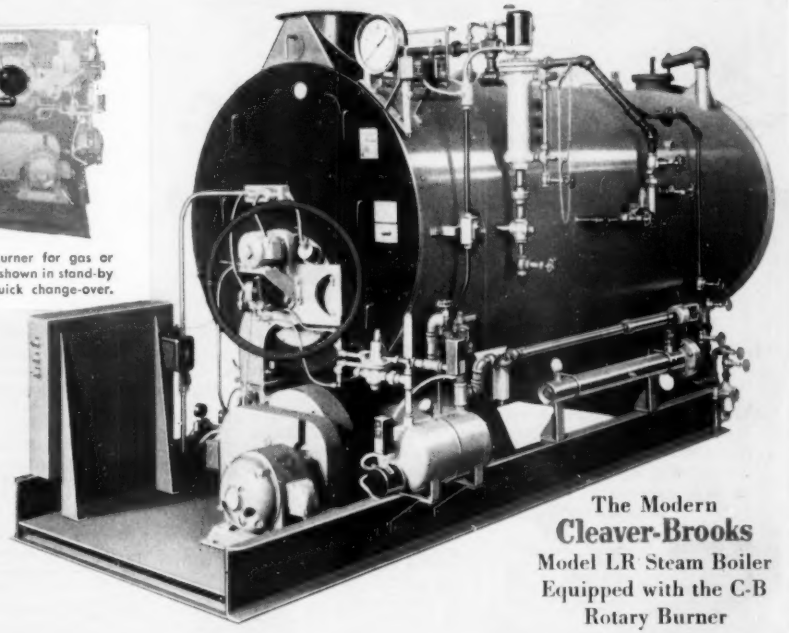
PYROMETER CONTROLLER

P527 • Compensation for heat transfer lags is claim for direct reading, indicating pyrometer controller *Model 293 Capacitrol*. *On* and *Off* variations above and below preset control point are reduced by built-in straight-line control unit. Size of instrument is 7⅝ x 8⅛ x 7-25/32 in.; it can be flush or surface mounted on heating equipment

unmatched Flexibility of operation ...and of quick fuel change-over



Combination burner for gas or oil. Oil burner shown in stand-by position for quick change-over.



The Modern **Cleaver-Brooks** Model LR Steam Boiler Equipped with the C-B Rotary Burner

✓ **Quick Steaming—Fast, effortless response to fluctuating steam demands**

✓ **Equally high efficiency using heavy No. 6 oils (or lighter oils) and all types of industrial gas**

IF the quantity of steam required in your plant fluctuates throughout the day, depending upon the amount of steam-using equipment in operation, you can cut your steam costs substantially with a Cleaver-Brooks Boiler. It operates at a full 80% guaranteed efficiency whether you require maximum load use of all steam-using equipment . . . or whether your equipment is not in use, requiring as little as 30% response — often just enough to heat the plant.

Install a Cleaver-Brooks Boiler — oil, gas, or combination — either fuel properly proportioned by the exclusive Cleaver-Brooks Burner to meet your fluctuating or constant steam demand. Fully automatic, clean, with a single source for all of its matched parts . . . you benefit with lower fuel bills, less maintenance, reduced operating costs, greater profits. Why not consider changing your present boiler plant and think of flexibility — remember Cleaver-Brooks and get the complete facts on boilers, 15 to 500 HP — 15 to 250 lbs. psi.

Write for latest, fully illustrated and descriptive Cleaver-Brooks Steam Boiler catalog.

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you can lose plenty if you're

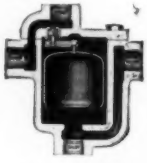
UNDER-TRAPPED

It doesn't pay to skimp on traps . . . especially steam traps. Water and air in steam lines reduces effective temperatures, wastes fuel and adds to maintenance costs.

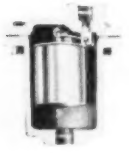
Clark Steam Traps have proven their outstanding drainage efficiency over many years of use in thousands of plants. Now, with the new Duo-Step double-drainage capacity feature, they can handle twice the condensate of ordinary traps.

It will pay you to see your Clark representative or write us for further information.

QUICK CLEANING STRAINERS. Remove dirt, scale and grit from steam, fluid and gas lines. Sizes ½" to 3" I.P.S.



SERIES "60" INVERTED BUCKET TRAP. Choice of horizontal or vertical inlet or outlet. For pressures up to 150 P.S.I. "Clark-loy" guided disc and seat.



CLARK "701" - D (DUO-STEP) TRAP. A forged steel trap for pressures up to 500 P.S.I. and temperatures of 750°F. Equipped with "double-drainage" Duo-Step leverage and venting, Clark-loy seats and discs. Pipe sizes ½" or ¾".

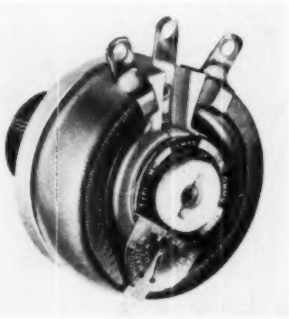
SERIES "80"-D (DUO-STEP) TRAPS. Cast semi-steel construction for pressures up to 250 P.S.I. and temperatures to 450°F. Equipped with Duo-Step Leverage and Venting, Clark-loy seats and discs. Pipe sizes from ½" to 2".

THE CLARK MANUFACTURING CO.
1830 EAST 38th STREET • CLEVELAND 14, OHIO

More EQUIPMENT NEWS

Begins on page 166

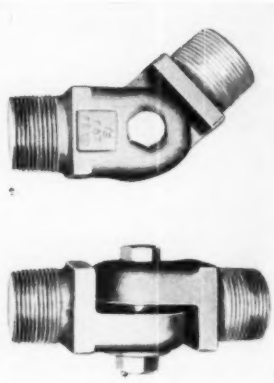
or instrument panels. Wide range of standard scales in various thermocouple calibrations is available.
Wheelco Instruments Co, 847 W Harrison St, Chicago 7, Ill.



RHEOSTAT

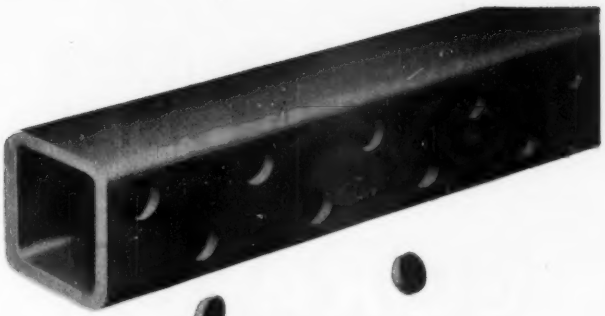
P560 • Blended with thermo-shock-proof enamal coating, Model H-50 rheostat offers protection under extremes of humidity and abnormal atmospheric conditions, plus resistance to excess heat and shock. It has minimum number of parts, uniform torque, adjustable pressure, smoother electrical control.
Hardwick, Hindle, Inc, Newark 5, N.J.

For more data on these items, use post cards, p 175. Identify request with P and number.



ADJUSTABLE ANGLE FITTINGS

P542 • Accurate vertical suspension of overhead type electrical equipment from sloping or arched roof members, angle mountings from walls or columns, and 90 deg adjustment are claimed for angle fitting. It can suspend loads up to 1500 lb. Fitting is made of high-strength heat-treated aluminum alloy with machined con-



Save copper with
CHASE BUS CONDUCTORS

You can cut your copper requirements for bus conductors up to 36% by using Chase ventilated square copper tube bus conductors, instead of rectangular flat bars.

Chase square copper tube buses can withstand heavy short circuit stresses because of their high mechanical strength. The large cross-sectional areas permit longer spans between supports without unduly large sags.

They have high thermal conductivity and low resistance voltage drop and power loss per pound of metal. Send for the Chase Copper Bus Conductor Handbook giving specifications and installation data.

Chase BRASS & COPPER

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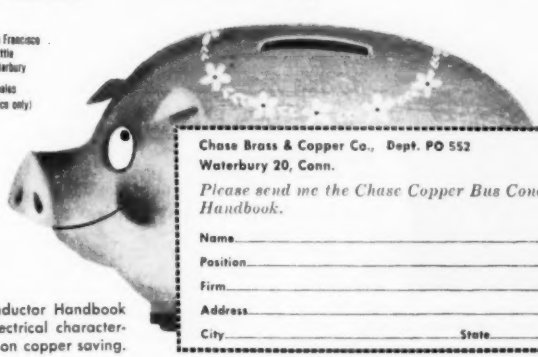
Baltimore	Denver†	Milwaukee	Pittsburgh	Waterbury
Boston	Detroit	Minneapolis	Providence	(†sales
Chicago	Houston†	Newark	Rochester†	office only)
Cincinnati	Indianapolis	New Orleans	St. Louis	



FREE Chase Bus Conductor Handbook gives physical and electrical characteristics as well as data on copper saving.

Chase Brass & Copper Co., Dept. PO 552
Waterbury 20, Conn.

Please send me the Chase Copper Bus Conductor Handbook.

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Position_____

Firm_____

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When You Think of

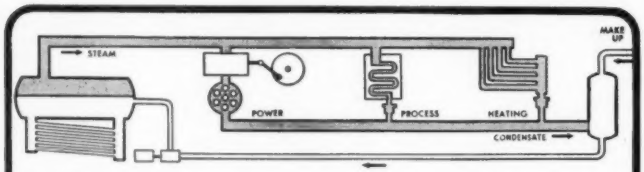
CORROSION PROTECTION for your STEAM SYSTEM

Think of

CORAVOL

(The Original* AMINE PROCESS)

Because CORAVOL Circulates to Control Corrosion



The CORAVOL ZONE—indicated by the shaded area in the diagram—includes every part of a steam system not accessible to boiler feed water treatment. It includes the boiler above the water line, steam lines, condensate return lines, radiators, valves, traps and equipment. This zone can now be reached and protected against rust and corrosive action—by CORAVOL.

CORAVOL IS PART OF A COMPLETE TECHNICAL SERVICE which provides special chemical formulas for . . . boiler feed water . . . foam prevention . . . hot water supply . . . refrigerating brine . . . cooling and condenser water . . . rapid scale removal . . . coagulation . . . algae control . . . fuel oil supply . . . soot removal.

CORAVOL circulating throughout your steam system protects it from corrosive attack. **CORAVOL** saves costly pipe repairs and replacements—maintenance labor—hours and days of shutdown loss. **CORAVOL** cleans out clogging rust deposits, improving heat transfer, restoring original capacity of lines and efficiency of valves and traps.

CORAVOL, the original* amine process, has the flexibility that lets it conform to each individual need. The **CORAVOL** you will use is formulated to do the best protective job under your own plant conditions.

*The use of **CORAVOL** in steam systems is covered by U. S. Patent No. 2053024. The Western Chemical Co., owner of this patent, grants licenses under which volatile AMINES purchased from other sources may be used in steam systems upon payment of royalty to Western Chemical Co.

Chemical Water Treatment

WESTERN CHEMICAL COMPANY

713 Washington Street
Kansas City 6, Missouri

MAIL COUPON TODAY for
Complete Data about the CORAVOL Process

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713 Washington Street,
Kansas City 6, Missouri

Send me full information about CORAVOL.

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CITY_____ ZONE_____

STATE_____

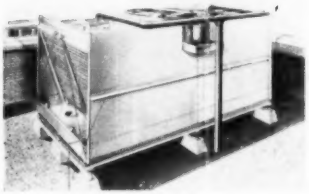
More EQUIPMENT NEWS

Begins on page 166

ical seats for hard, radial knurled, double-cone plugs that join the halves.

The light duty model has ¾ in. male pipe threads and is designed for units weighing under 60 lb. Medium duty fitting with 1-in. male pipe threads handles loads from 60 to 100 lb. And the heavy duty model with 1¼-in. male pipe threads can take loads up to 1500 lb.

Thompson Electric Co, 1111-92 Power Ave, Cleveland 14, Ohio



COOLING TOWER · P561

Compact double-flow *Aquatower* requires low pumping and fan power, has weight evenly distributed over wide area and has all parts readily accessible. Made in seven standard sizes, starting with a 50-ton unit. Available in all steel or wood with asbestos cement-board casing. Tower is suitable for use in power, petroleum, gas, chemical and food processing, metal-working industries and wherever air conditioning and refrigeration are used.

Marley Co, Inc, 222 W Gregory Blvd, Kansas City, Mo.

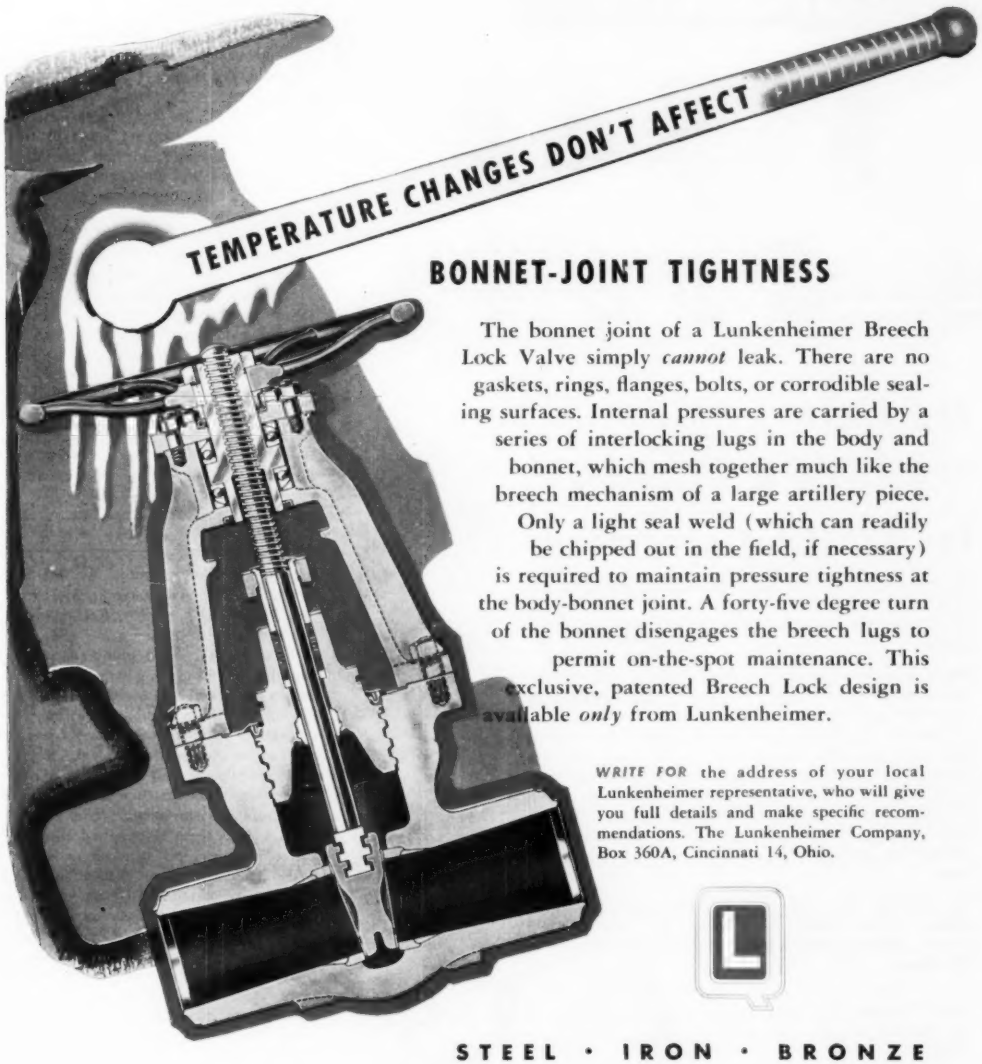
For more data on these items, use post cards, p 175. Identify request with P and number.

UNIVERSAL MOTOR

P562 · Rated 1/40 to 1/12 hp, universal motor EMC Model 1120 features new die cast and flat-sided case for easy mounting and precise alignment. Unit has ventilated housing, and finds application where gears are not used. Bearings are porous-bronze sleeve type with felt oil reservoir. Internal fan is standard, weight 2 lb, no load speed 15,000 rpm, full load speed 7,500 rpm and continuous duty rating 1/30 hp.

Howard Industries, Inc, Racine, Wis.

IN BREECH LOCK VALVES



BONNET-JOINT TIGHTNESS

The bonnet joint of a Lunkenheimer Breech Lock Valve simply *cannot* leak. There are no gaskets, rings, flanges, bolts, or corrodible sealing surfaces. Internal pressures are carried by a series of interlocking lugs in the body and bonnet, which mesh together much like the breech mechanism of a large artillery piece. Only a light seal weld (which can readily be chipped out in the field, if necessary) is required to maintain pressure tightness at the body-bonnet joint. A forty-five degree turn of the bonnet disengages the breech lugs to permit on-the-spot maintenance. This exclusive, patented Breech Lock design is available *only* from Lunkenheimer.

WRITE FOR the address of your local Lunkenheimer representative, who will give you full details and make specific recommendations. The Lunkenheimer Company, Box 360A, Cincinnati 14, Ohio.

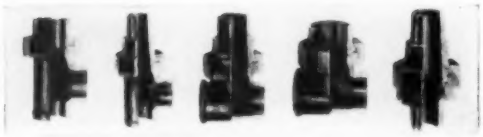
STEEL • IRON • BRONZE

LUNKENHEIMER

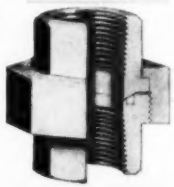
THE ONE *Great* NAME IN VALVES

L-551-2

Jefferson
AIR-TESTED AIR-REFINED MALLEABLE IRON
UNIONS
featuring the RECESSED BRASS SEAT



There are
"JEFFERSONS"
for YOUR piping needs



No matter what your requirements—if your piping system calls for any type of union, there's a Jefferson to fill the bill, assure permanent tightness and simplify your piping layout.

Every Jefferson Union of whatever type features the exclusive Recessed Brass Seat . . . a construction assuring drop-tight performance without jamming. This design consists of a brass ring cut from seamless drawn tubing (not a casting) which is forced into a *machined* retaining channel in such a way that it cannot rock loose. The ring is ground with its mating iron component to form a joint of truly spherical surface contact. Location of this seat-ring is such that it permits free flow through the fitting without the possibility of contact with screwed-in pipe ends.

The Jefferson line also includes AAR male and female unions, Enduro 300#, Excel 250# and Master 150# unions. All-iron ground seats can also be furnished in all types.

Get full details from your nearest distributor — or contact us direct.

Jefferson UNION CO.
605 W. 26th ST., NEW YORK 1, N.Y.
63 Gooding St., Lockport, N.Y. 39 Fletcher Ave., Lexington 73, Mass.

More TECHNICAL BRIEFS

Begins on page 162

more remarkable because it has been known that about 40% of the fuel energy escapes through the exhaust pipe and that a fair portion of this can be harnessed. According to some authorities the convertible exhaust energy of an ideal non-supercharged diesel engine runs about 9%; of a highly (2 atm) supercharged diesel engine, 17%; of a non-supercharged spark ignition engine, 24% of the fuel energy. Turbocharged engines recover some of this energy in exhaust turbines. In non-supercharged and in mechanically supercharged engines this energy usually goes to waste.

The investigation reported by the author and sponsored by the Office of Navy Research, has been in progress for almost four years and this paper covers the highlights of that phase of the program completed by the end of 1950. The experiments employed an "air model" and a "water model" to study interference between cylinders and develop better exhaust manifolds. The author reviews briefly the factors that determine relations between exhaust pipe and engine performance. *ASME Paper. No. 51-A-132.*

Directions for ordering papers on p 164

Measurement of Hydraulic Turbine Vibration. *By John Parmakian and R S Jacobson, U.S. Bureau of Reclamation.*

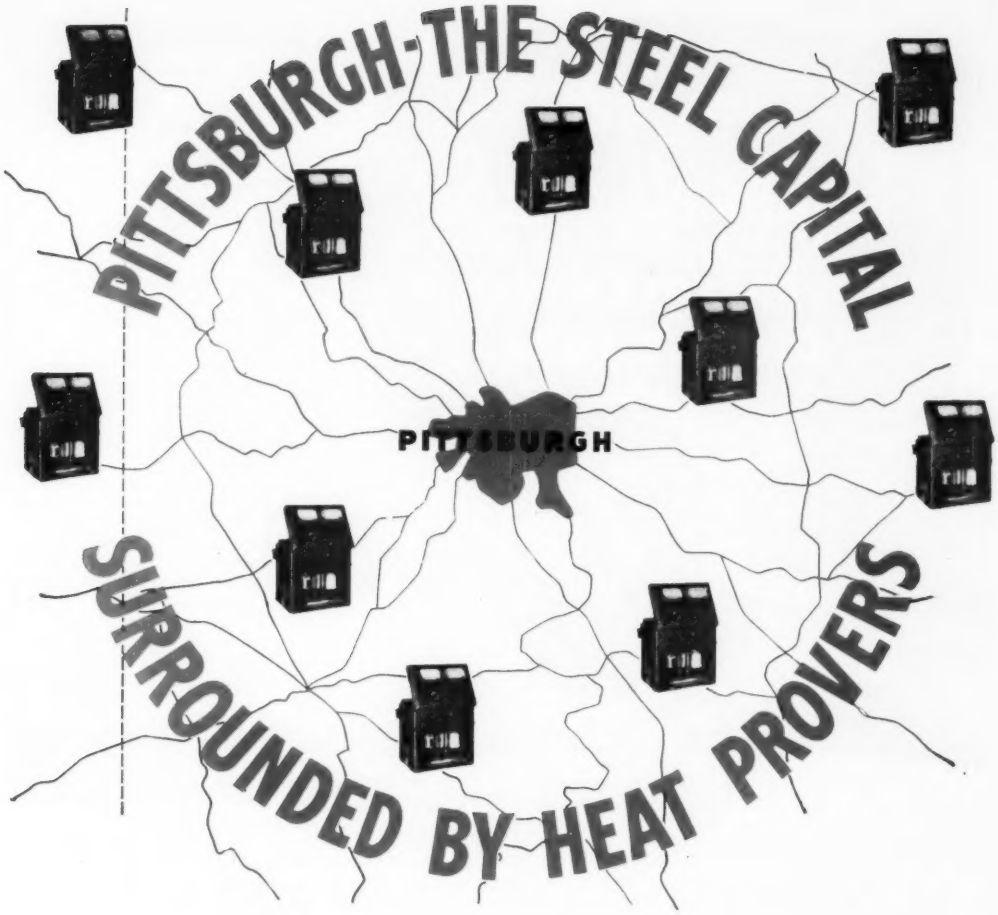
This paper describes a test program used to measure and eliminate vibration that was producing extensive cracking in the blading of a slow-speed, 40,000-hp hydraulic turbine. Strains, accelerations, and pressures were measured at various locations on the turbine runner while the unit was in operation.

Resistance-type instruments were used for these measurements. The instrument signals were transmitted through collector rings and brushes to direct writing oscillographs. Vibration was successfully eliminated by an inexpensive modification of the runner blading.

The trailing edges of all runner blades were chipped and ground along their entire length. This eliminated periodicity of turbine blade vibrations and reduced vibration accelerations to small fractions of their previous values. Further, the power output of the unit for all gate positions increased 6.5% in the maximum output loading. *ASME Paper. No. 51-A-88.*

Gas Turbines

Gas Turbine Development in Europe and the U.S.A. *By F T Hague, Westinghouse Electric Corp.*



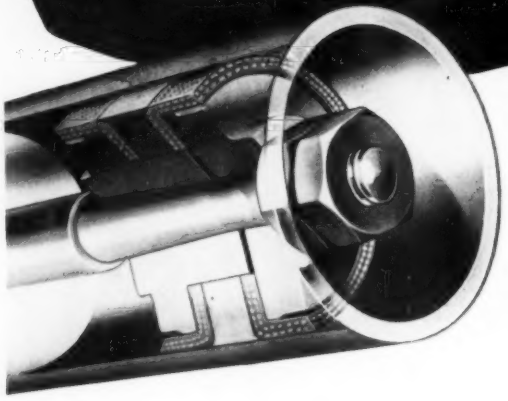
When your eye is on Pittsburgh—and three dozen towns in its orbit—you're spotting scores of furnace operations regularly checked by Cities Service Heat Provers. Here, where they know all kinds of furnace instruments, and where high efficiency is most urgent today, the application of Heat Provers by Cities Service is increasingly valued.

It takes the Heat Prover to read simultaneously for oxygen and combustibles, measured direct by actual gas analysis. And the Heat Prover's continuous rapid sampling reveals effects of furnace adjustments at once. The Heat Prover frees you of maintenance too, because it's *not an instrument you buy, but a Service we supply.* Learn how it can raise productivity for you . . . in iron, steel, ceramics, glass, cement or any other furnace operation. Write CITIES SERVICE OIL COMPANY, Dept. E22, Sixty Wall Tower, New York City 5.

CITIES SERVICE

QUALITY PETROLEUM PRODUCTS

YOU GET
higher efficiency
WITH DARCOVA PUMCUPS
ON THE JOB!



THERE are two basic, well-proved reasons why more and more Darcova Pumcups are going into cylinders of air and hydraulic controls and mechanisms.

First, texture-engineered Pumcups outlast most other piston packings at least 3 to 1. There's less replacement, less down-time!

Secondly, efficiency *does not diminish* as Pumcups wear. Response is always faster, surer, with less power consumed!

Darcova Pumcups are available in sizes and engineered textures ideal for virtually any service. Why not find out what they can save *you?*

ASK FOR BULLETIN No. 4502

DARLING VALVE & MANUFACTURING CO.

Williamsport 8, Pa.

DARCOVA
THE ORIGINAL COMPOSITION CUP
PUMCUPS

More TECHNICAL BRIEFS

Begins on page 162

The prospect of gas turbine applications and the pattern of their development is basically similar but differs in essential respects in Switzerland, England and United States. The gas turbine is now an economic and practical reality in all parts of the world. Its fields of application exist when the cost of fuel, plant load factor or plant first cost is sufficiently low or where the advantages of small size, portability or absence of water requirements can be evaluated. In the low cost liquid and gas fuel regions of the world the complete gas turbine plant proves superior to the complete steam plant in sizes up to 15,000 kw. This dividing line may be doubled within the next few years, as attractive new forms of gas turbine plants now building are proven out in operation. In the abundant coal regions the steam plant is unchallenged by the gas turbine for large power generation and significant improvement in coal burning for gas turbine use must be made before any change in this situation can take place.

In Switzerland Brown Boveri have 17 sets built or building and have put in operation throughout the world 14 gas turbine units totalling 85,000 kw. (P Sidler, *ASME 51-A-104.*) These are open cycle units with 1112 F top temperature, employing compressor intercoolers and regenerators in various combinations.

By U.S. standards, an 1112 F gas turbine would weigh at least 100% more than a 1400 F unit. This 1112 F is a steam turbine temperature level and gas turbines using it could mainly use conventional turbine steels instead of costly high-temperature alloys. The axial flow compressors and turbines of these machines employ two to three times as many stages as is conventional in modern U.S. practice. This increases weight but simplifies the design and adds materially to the efficiency. The accessory equipment (piping, heat exchanger, etc.) in these plants is well over double the size required on a 1400 F unit.

The entire Swiss experience might be summed up by noting that the absence of aviation gas turbine development projects in Switzerland has shielded them from the stimulus of undertaking the higher temperature gas turbine research that many in England and the U.S. feel is the logical goal for the gas turbine of the future.

The non-aviation gas turbine situation in England is strongly supported by government funds through contracts with private firms. This is part of an overall plan to have England develop

Sludge . . . a water formed sedimentary deposit which may include all suspended solids in the water. Sludge usually does not retain its physical strength when removed, but it may bake in place and become hard and adherent . . . (Ref. ASTM D 887, D 933).

Use DREW POWER CHEMICALS

Tube failure, expense and inconvenience . . . even plant shut down . . . frequently results from baked-on sludge. Sludge often resembles scale and frequently causes the same troubles. It's the function of every good boiler water treatment to prevent the adherence of sludge as well as scale.

So we say, "Draw a Bead on Boiler Sludge, Mr. Engineer." Call in the Drew engineer. The water samples and operating data that he obtains in your plant will be thoroughly analyzed in the Drew Laboratories, and you'll be given specific recommendations for corrective Drew treatment. Furthermore, your Drew engineer will give you frequent and continuous help in your plant.

Thorough investigation, proper treatment, and frequent service have made Drew one of America's fastest growing water treatment companies. Consult the nearest Drew engineer or write for information.

Power Chemicals Division

E. F. DREW & CO., INC.

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SAN FRANCISCO CHICAGO PHILADELPHIA BOSTON DALLAS

Service throughout the United States, Canada and South America

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DRAFT FANS

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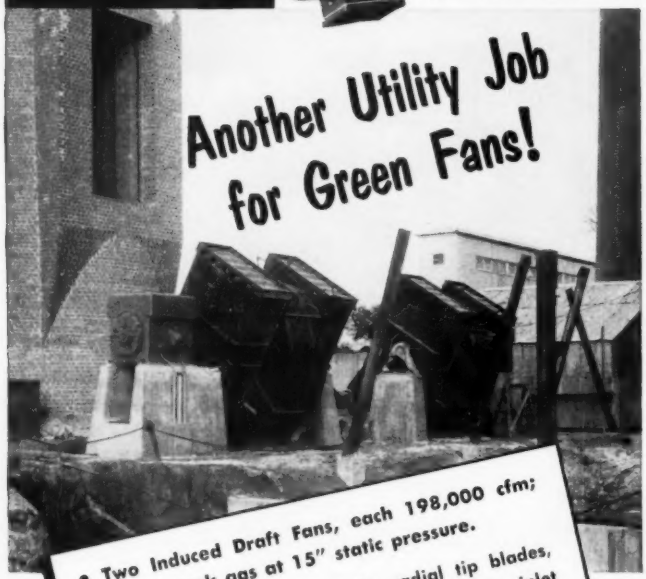

- Two Induced Draft Fans, each 198,000 cfm; 300°F stack gas at 15" static pressure.
- And special features include: radial tip blades, erosion-resistant wheels, control type inlet dampers, air-cooled bearing for outdoor service.

This installation, located in the South, adds to the mounting evidence that Green Draft Fans are very much in the boiler plant picture, both utility and industrial... evidence that they are high on the specification lists of leading consulting engineering firms and on the owners' lists of acceptable equipment.

There are numerous things about Green Induced and Forced Draft Fans that make them desirable auxiliary equipment for any boiler. We suggest that you have the basic facts at hand when you start planning for *your* fans. Send for our Bulletin 168 and in writing, tell us about your requirements.

Photo above shows the Green 1D Fans being installed in the Chesterfield Power Station Extension of the Virginia Electric and Power Co., at Drewrys Bluff, Virginia.

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- Cinder traps
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More TECHNICAL BRIEFS

Begins on page 162

technical leadership in all kinds of gas turbines and to profitaby sell such technology directly or through patent licenses throughout the world. In 1945 an instrument of the nationalized government, the British Electrical Authority, apparently decided to invest in power generation projects that would advance England's technological position in this field by actual experience through design, building and operation of large new gas turbine units. *ASME Paper. No. 52-S-9.*

Radial Flow Compressors and Turbines for Simple Gas Turbines. *By L R Wosika, Solar Aircraft Co.*

The Navy requested us to develop a 45 hp portable diesel-fuel burning, gas-turbine-driven fire pump. They climaxed the specifications with a demand that the unit be started by hand cranking. This was an entirely new engineering problem on top of several other difficult specifications, such as low weight, small dimensional cubic package for portability, and compressor inlet temperatures above 120 F. Two manpower for starting the machine appeared to dictate a rather low pressure ratio and indicated that a very high specific fuel consumption would result if the small size components gave poor efficiency.

We decided that the configuration required would not allow using the axial flow compressor and turbine; and, if we were to develop an acceptable unit, we must go to radial flow.

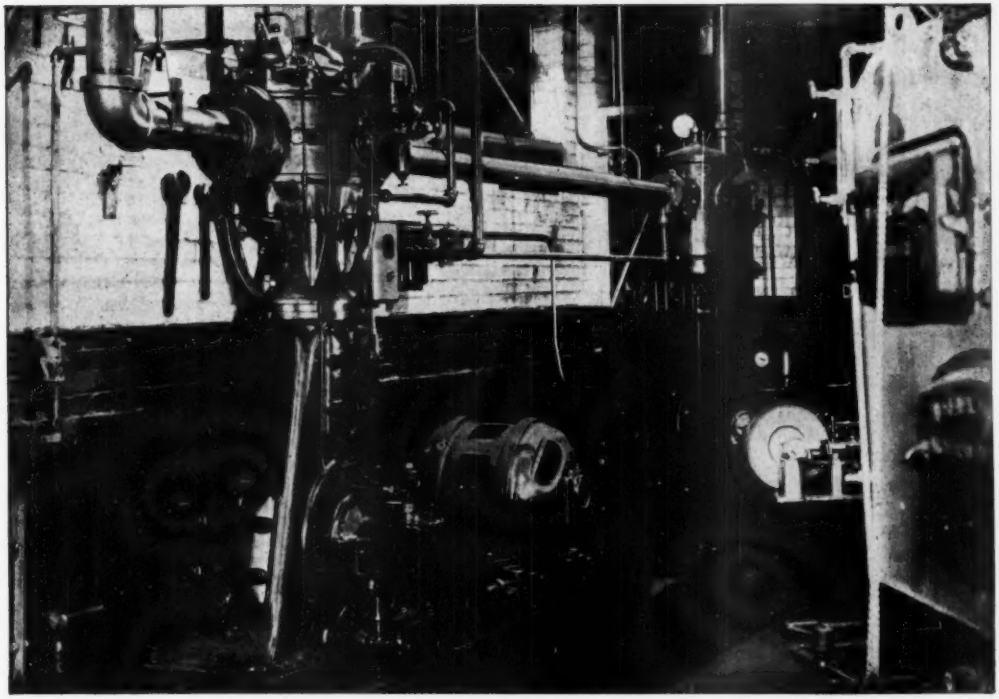
We uncovered a paper in the *Technical Data Digest* on "The Radial Turbine" which had just been released at Wright Field. From this paper and from what we obtained from delving into British and German radial machine practices, and from long consultations with authorities on the subject, we reached an acceptable design that equaled or bettered the Navy specifications in most instances.

This paper reviews data and current best design practices and compromises to arrive at a practical design of a simple cycle radial-flow gas turbine. Further it discusses the several factors and variables that affect performance. *ASME Paper. No. 52-S-13.*

Directions for ordering papers on p 164

High Temperature Gas Stream Measurements. *By E R Letsch and W J King, Univ of California.*

Conventional methods of measuring temperatures in hot gas streams are subject to large errors, due to heat exchange with surroundings and impact



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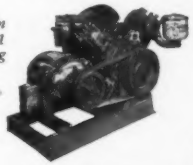
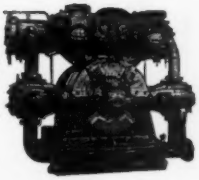
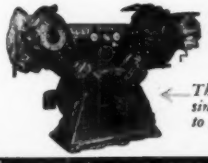
The JOY WG-9 Vertical, with its small base, saves valuable floor space. Built in a range of sizes to 881 CFM, for continuous heavy-duty service. The complete line of JOY stationary units—high and low pressure compressors, oil-free compressors, boosters and vacuum pumps—includes a type for every need, each incorporating exclusive features developed by JOY research. Supplementary products include the only complete line of vaneaxial fans and blowers, and the new JOY Oxygen Generator. ● *Write for free Bulletins.*

The JOY WL-80, in eleven sizes up to 641 CFM, with operating pressures to 125 psi.

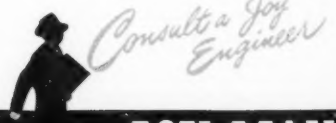


The JOY WN-114, in single or twin units up to 7312 CFM.





The JOY WN-112, in single or twin units up to 3656 CFM.



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More TECHNICAL BRIEFS

Begins on page 162

effects at high velocities. The factors affecting these errors make up part of this paper. The error magnitudes under various conditions are indicated in tables and a graph.

The paper summarizes the published literature on the subject and the various techniques developed to date. The authors also discuss limitations of these methods and recommend procedures for particular conditions.

With the increased emphasis in recent years on research, development and production of gas turbines, jet engines, rockets and similar devices the need for information on adequate means for measuring high temperatures in gas flow systems has become pronounced.

The present paper was sponsored by the Gas Turbine Power Div to review the state of the art, hoping to bring the subject up to date as far as practicable. Only very brief reference is made to the underlying thermodynamic fundamentals. *ASME Paper. No. 51-A-143.*

Heat Pumps

Design Factors for Industrial Heat-Pumps. *By R J Martin, Univ of Illinois.*

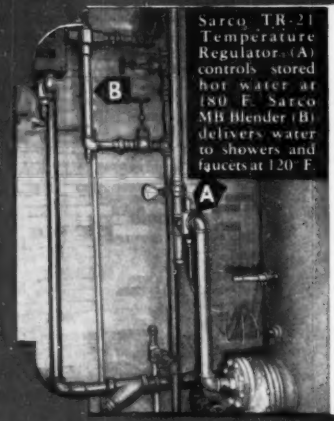
Using the heat-pump to heat commercial and residential buildings has received much attention from heating and refrigeration engineers in the past few years. Such systems employ a conventional refrigeration cycle: the evaporator absorbs heat from the atmosphere, ground, or other source, and the condenser of the refrigeration cycle rejects heat at the higher condensing temperature. By means of a suitable medium, like water or air, this heat offsets the heat losses of the building.

The amount of heat thus made available is essentially the sum of the heat absorbed by the evaporator and the heat equivalent of the electrical energy required to drive the refrigeration compressor. One advantage is the possibility of its use for summer air-conditioning, where the functions of the heat-pump evaporator and condenser interchange. Heat is absorbed from the building and rejected to the atmosphere, or other suitable heat sink.

Many industrial plants now use refrigeration equipment to control the manufacture of their products. This refrigeration equipment may be designed to serve as part of a heat-pump system for preheating process water or for controlling the temperature of processes. Such design factors as evaporating temperatures, condensing temperatures, condenser water flow rate, and

Directions for ordering papers on p 164

Don't Waste It



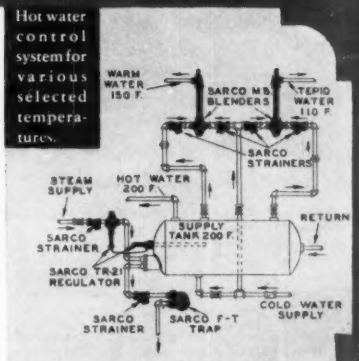
Sarco TR-21 Temperature Regulator (A) controls stored hot water at 180 F. Sarco MB Blender (B) delivers water to showers and faucets at 120 F.

In most plants and institutions hot water is stored for periodic use in process work, gang showers, group wash basins, etc.

Much of this water (often carried at 180 or 200° F) is wasted by allowing manual temperature adjustment at the point of use.

Avoid buying additional Water Heater capacity by installing Sarco Water Blenders.

Blend It



Hot water control system for various selected temperatures.

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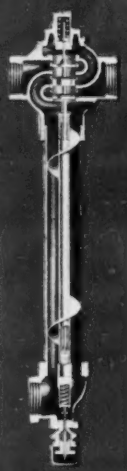
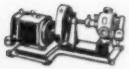


Sarco Water Blender type MB provides tempered water at any desired constant temperature.

Sarco Water Blenders



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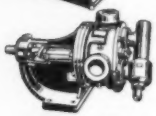

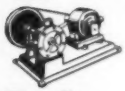

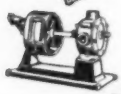

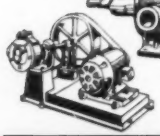

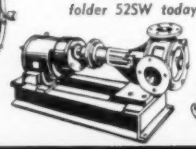

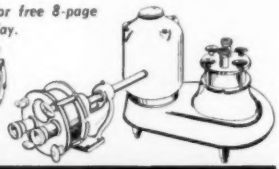

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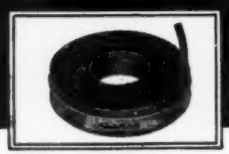

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More TECHNICAL BRIEFS

Begins on page 162

leaving condenser water temperature influence the design, economic analysis, and performance of such heat-pump systems. The author discusses heat-pump performance and operating costs, compared to other means of supplying heat energy, and proposes possible methods of solution to problems. *ASME Paper. No. 51-A-75.*

More POWER NEWS

Begins on page 160

achievements air conditioning is certain to be studied and applied more frequently as a production tool. The potential is tremendous.

The last major market segment—the home—is absorbing a quantity of year-round air conditioners already. But price is still beyond the reach of the vast majority. Until this principal obstacle can be brought closer into the limits of the average home owner's purchasing power this market must remain mostly in the future.

Reclaimed Anthracite Feeds Giant Boiler

World's largest anthracite coal-fired steam generator, 700,000 lbs per hr, is now being manufactured by Foster Wheeler Corp, for the Holtwood, Pa., hydroelectric and steam generating plant of the Pennsylvania Water & Power Co.

Bituminous coal or oil are the fuels used in the vast majority of the nation's steam-generating plants with a comparative few using anthracite for their boilers. Penn Water's operation is unique. The Susquehanna River, on which its hydro plant is located, flows through the Pennsylvania anthracite fields 150 miles above Holtwood. Over the years this stream has brought millions of tons of coal, in particles about the size of a pin head, down stream. Pennsylvania Water and Power Co "mines" this coal from (1) the bottom of Lake Aldred (2) behind the Holtwood dam and Lake Clarke (3) behind the Safe Harbor Water Power Corp dam 8 miles upstream from Holtwood. The silt deposits—part sand and loam and part fine coal particles—are recovered and the coal is separated from the waste, then pulverized and burned in the steam plant. Cost of this "river coal" will be considerably lower than that of bituminous coal or other available fuels purchased on the open market.

The 24th Annual Conference and Exhibit of the **Oil & Gas Power Division,** ASME, at the Statler Hotel, Buffalo, New York, features design, operation and maintenance of diesel, dual fuel and gas engines. Technical sessions will include papers on engine lubrication, spark ignition gas engines, crank shaft design problems and diesel engine power plants.

(*More Power News on page* 208)

You've heard of FLUOR QUALITY ...here's proof

You've only to look into a Fluor Counterflo Cooling Tower for the proof of quality—quality of design, of manufacture, of performance, and of appearance. The points illustrated below are just a few of the many features that have earned Fluor Towers their enviable reputation for quality—compare them when next you buy or specify.

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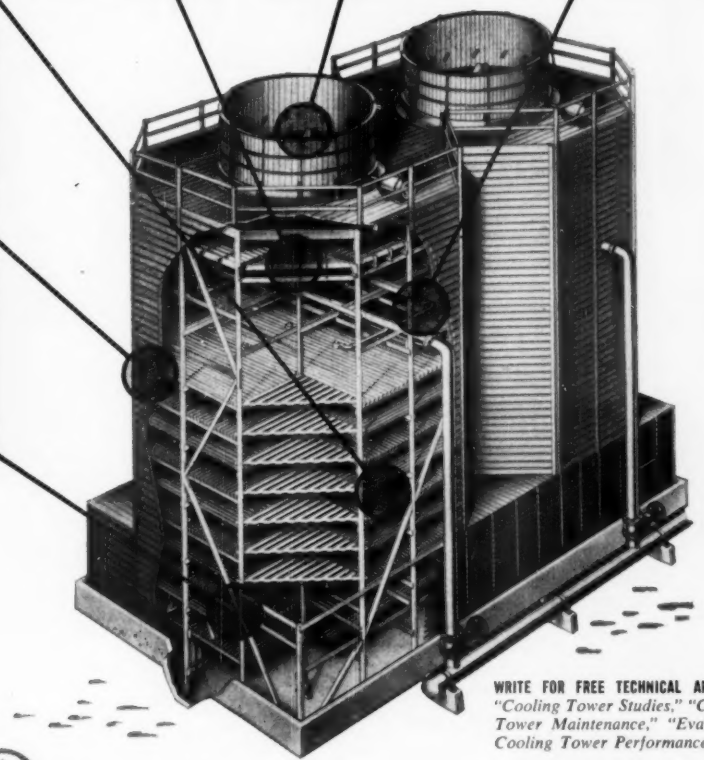

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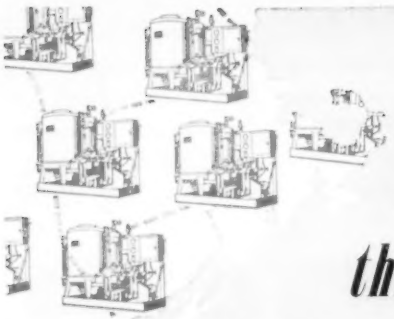

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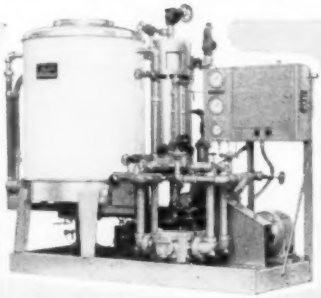

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More POWER NEWS

Begins on page 160

COMING EVENTS

April 30-May 2—American Institute of Electrical Engineers, district meeting, Arlington Hotel, Binghamton, N. Y. H H Henline, secy, AIEE, 33 W 39th St, New York 18, N. Y.

May 5-6—Second National Air Pollution Symposium, Huntington Hotel, Pasadena, Calif. Dr A M Zarem, chairman, Room 332, 612 S Flower St, Los Angeles.

May 20-21—Nuclear Energy Conference, Michigan State College, East Lansing, Mich. D J Renwick, asst prof mech engrg, chairman.

May 28-29—Spring meeting, Prime Movers Committee, Pennsylvania Electric Assn, Tidewater Inn, Easton, Md. E Gordon, chairman, Potomac Edison Co, Hagerstown, Md.

June 9-12—Air Pollution & Smoke Prevention Assn of America, Statler Hotel, Cleveland, Ohio. Robt T Griebling, exec secy, APSPAA, Mellon Institute, Pittsburgh, Pa.

June 11-13—Wisconsin Power Conference, Associate Engineers and Supplymen of Wisconsin, Schroeder Hotel, Milwaukee, Wis. K W Knoelk, secy, Rt 5, Box 343, Waukesha, Wis.

June 15-19—American Society of Mechanical Engineers, semi-annual meeting, Sheraton Gibson Hotel, Cincinnati, Ohio. O B Schier, meeting chairman, ASME, 29 W 39th St, New York 18, N. Y.

June 23-27—American Society of Mechanical Engineers, Oil and Gas Power Div, Statler Hotel, Buffalo, N. Y. O B Schier, meeting chairman, ASME, 29 W 39th St, New York 18, N. Y.

June 23-27—American Institute of Electrical Engineers, summer meeting, Nicollet Hotel, Minneapolis, Minn. H H Henline, secy, AIEE, 33 W 39th St, New York 18, N. Y.

GE Packages Heat Pump

General Electric Co made first commercial shipment of its new packaged heat pump—all-electric air conditioning unit—said to provide effective year-round push-button weather in the home or office. Device is being marketed after more than 15 years of development and field testing.

H M Brundage, mgr of the company's air conditioning dept stated GE is already receiving orders for these units scheduled for assembly line production. Principal market, he said, is expected to be in new homes, stores and offices, with or without basements.

The heat pump operates on the same principal as an electric refrigerator except that the cycle is reversed to provide heat instead of refrigeration when heat is required.

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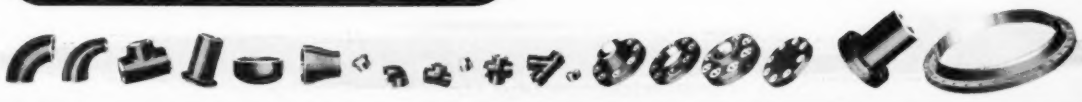
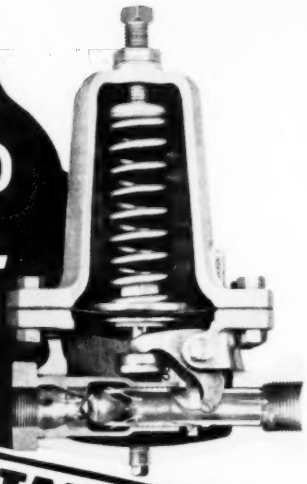


PUT IT ON THE LINE AND *forget it*



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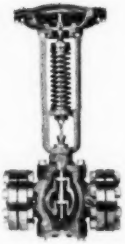
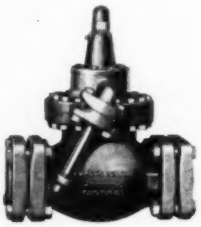
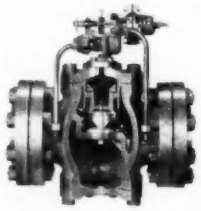


Bulletin 968 features the CASH STANDARD Type 34 Pressure Reducing Valve — direct operated — direct acting for handling steam, hot water, cold water, air, oil, brine—and most liquids and gases except some injurious chemicals. Illustrates and describes the different styles available and tells about their applications. Three pages of capacity charts.



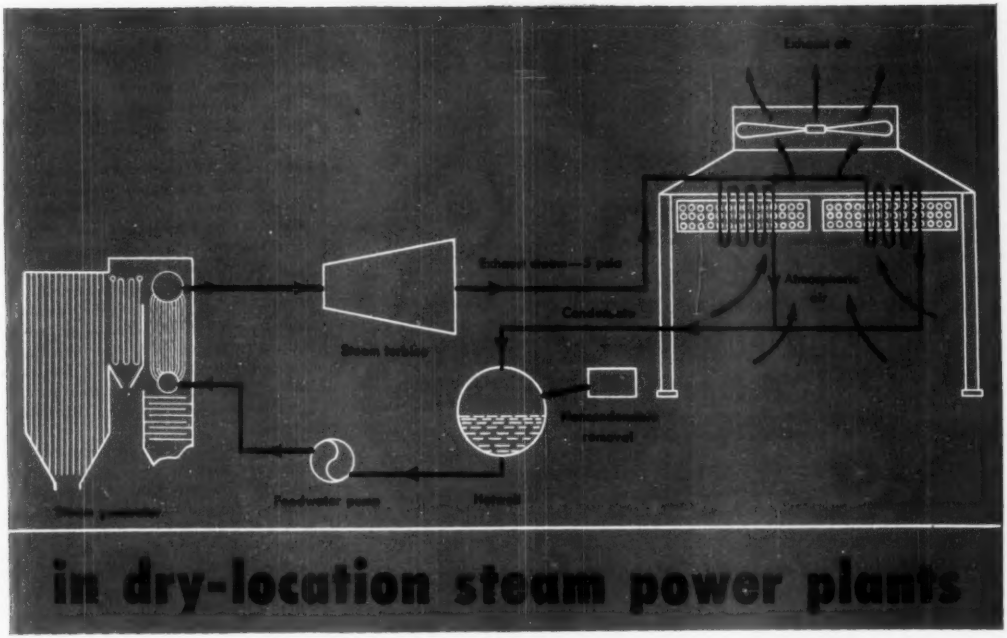
Bulletin 956—features the CASH STANDARD Type 4030 Back Pressure Valve — designed to automatically maintain a constant pressure in the evaporator corresponding to a constant temperature desired. Shows an Ammonia and Freon Gas Capacity Chart based on ABSOLUTE pressures.



Bulletin 966—features the CASH STANDARD Self Contained, Pilot Operated Type 10 Pressure Reducing and Regulating Valve for use with water or air, with any gas or oil that is non-corrosive, and with refrigerating fluids such as Ammonia and Freon. Many interesting particulars explained such as: how valve works, tight seating, large capacity, no waste, no water hammer or chatter.

ALCO AIRCOOLERS

condense steam



in dry-location steam power plants

In industrial steam power plants located where water is at a premium and make-up expensive, ALCO Aircoolers as shown in the illustration serve effectively and economically as condensers of exhaust turbine steam.

These dependable units use air as the cooling medium, with one or more induced-draft fans carrying the air upward through the tube bundles in which the steam is condensed. Their efficient design eliminates such difficulties as scale, costly water treatment, and other cooling problems.

The heart of the ALCO Aircooler is the ALCO fin tube, which provides an extended outside surface for maximum heat transfer efficiency, coupled with low air-flow resistance for economy in operation. A continuous helically wound copper fin is bonded to the tube with lead-tin alloy, and the external tube surface is coated with this alloy to improve atmospheric corrosion resistance. The entire unit is quickly and easily assembled in the field.

For details call your nearest ALCO Sales Engineer at Beaumont, Chicago, Dunkirk, Houston, Los Angeles, New York or Tulsa.

Send Coupon for ALCO Aircooler Bulletin.

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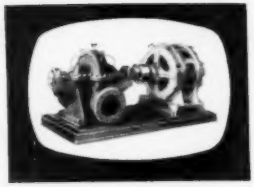
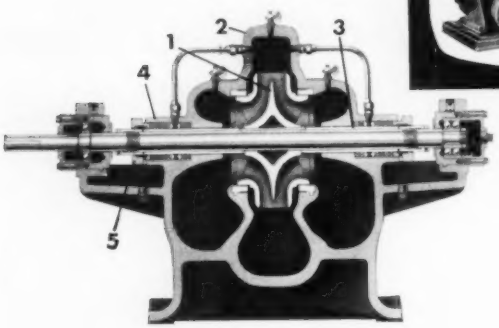
GOULDS Fig. 3450—Single-stage centrifugal pump; Capacities up to 15,000 G.P.M. Heads up to 500 ft.





These **5** *features mean*

HIGH PUMPING EFFICIENCY
LOW MAINTENANCE COST
LONG SERVICE LIFE

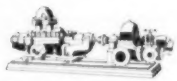
Whenever you need a pump for *general water supply, in-plant circulation of liquids, booster service or low pressure boiler feeding,* check the economy features these sturdy Goulds single-stage centrifugal pumps offer.

1. **HYDRAULICALLY BALANCED IMPELLERS** assure freedom from vibration.
2. **HORIZONTALLY SPLIT CASING,** matched and dowelled, makes access to working parts easy. All water passages exceptionally smooth due to careful core making.
3. **HEAVY BRONZE SHAFT SLEEVE** ground to smooth finish reduces friction. Saves power. Reduces wear on packing.
4. **DEEP STUFFING BOX** and bronze water seal ring minimize chance of leakage.
5. **GLAND HORIZONTALLY SPLIT AND BOLTED** to make repacking easy.

These pumps are available in all-iron or all-bronze construction, as well as standard bronze fitted. Maximum interchangeability of parts keeps inventories at a minimum. For complete details and specifications send for Bulletin 721.2.

Other GOULDS PUMPS for power and plant services

GOULDS Fig. 3047—Vertical sump pump with nonclogging impeller for water containing solids or fibrous materials. Bulletin 726.1.



GOULDS Fig. 3360—High pressure multistage centrifugal. Capacities to 2250 G.P.M. Heads to 3050 ft. Bulletin 722.5.

GOULDS Fig. 3650—"Close-cupld" single-stage centrifugal for general industrial use. Capacities to 2000 G.P.M. Heads to 400 ft. Bulletin 710.1.

MEMBER HYDRAULIC INSTITUTE U.S.A.

Goulds PUMPS INC. Seneca Falls New York

MARMADUKE

Continued from page 154

tion-test gadgets,' with him this morning—whatever that is. He also mentioned something about having to do some 'pitching'."

That's all I wanted to hear. "What a story," I said to myself. "Especially if Marmaduke comes through with some masterminding." An hour later, I was in the tannery powerhouse.

There was Marmaduke, sitting in the Chief's swivel chair, with his feet propped up on the desk. His gray bowler was down at the bow and a six-inch Havana poked out of his kisser. He was blowing a No. 4 Ringelmann smoke screen over the heads of the powerhouse boys who surrounded him.

"If he's having a tough time, he sure don't show it," I thought to myself.

Then I noticed that every fireman, maintenance mechanic and oiler had a Havana poking out of his face. Looking closer, I saw they all had a faraway look in their eyes. And there was a powerful odor of Sandpaper Gin about the place.

In one corner, the feed pump had a temporary suction, piped into a large water tank on the floor. A large platform-type measuring scale above it on a work bench had a small feed tank, for gravity-feeding the measured water into the large tank for the evaporation test.

At one side of a boiler was what was left of a pile of coal. Looked like it had been measured out for the test. I couldn't see a calorimeter anywhere for measuring the moisture in the evaporated steam, but maybe it didn't matter.

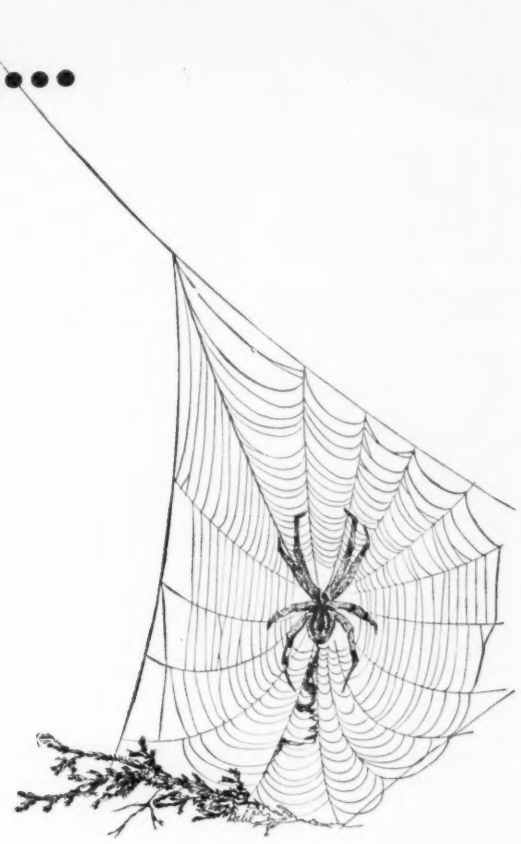
"Look here," roared Marmaduke just then, standing up. "It's three o'clock and in two more short hours our very pleasant two days together will be shot. We've had a nice lunch at Grogan's Clam House across the street, washed down with some mighty high-powered refreshments. But the hell with business, mates. Let's forget about this test and just be good shipmates for our last two hours together."

"HOORAY FOR MARMADUKE," yelled his unsteady admirers, as one man. "HOORAY FOR GOOD OLD MARMADUKE."

"So," continued this extraordinary consulting engineer, "I never forget friends and I've got a happy surprise for you." With that, he opened his suitcase. From it he pulled two boxes of Havana cigars and two bottles of Sandpaper Gin. These he carefully placed on the Chief's desk. "HOORAY FOR GOOD OLD MARMADUKE," yelled his disciples again, with eyes glued on the desk.

"Let's wind this party up right," continued Marmy, blowing more smoke. "All this belongs to the man with the

fabricating...



Death to insects, a wonder to children and bane to housewives, spiders perform a kind of garden variety of fabricating. We couldn't begin to compete.

The fabricating we do is with piping and tubing, and must come out just as geometrically accurate as the spider's product. In the case of bent tube type boilers, our skilled operators and equipment turn out tubes which will fit readily into your boilers, no matter how intricate the bends . . . or how many. Our men are trained in precision work, and every tube is carefully checked before it leaves our plant. We know ahead of time that you'll have trouble-free installation, and at minimum cost.

In addition to our boiler tube warehousing, pipe and tube bending and welded fabrication, we are now offering two added services to our customers: an Engineering Department and a complete Machining Department. Our new, larger plant at Catasauqua, Pa. means greater volume and faster production schedules for better delivery.

An unusually large stock of tubes for those emergency repair jobs means no waiting. And, like the web in the picture, our fleet of trucks reaches even distant points with dispatch, meets customers' deadlines on time.

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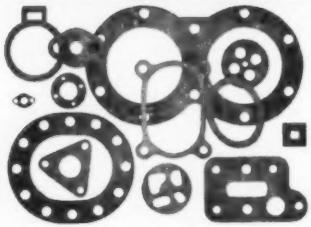

There's a Belmont Gasket — molded, formed, extruded, or die or lathe cut—for every gasketing service. They're made for *better* joint and surface seals . . . under any combination of service conditions . . . from a wide range of materials including Compressed Asbestos, Woven Asbestos Metallic, Red Rubber, Cloth Inserts, Black Rubber, Vegetable Fibre, Cork-Vegetable, Gray Rubber, Neoprene, Buna-N, Teflon, Silicone and many other compounded materials.

Because Belmont Gaskets are accurately and uniformly cut from just the right material to suit your particular service, they can usually be expected to deliver a valuable saving in maintenance costs and uninterrupted service by providing longer, more dependable service life.

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Acids • Alkalies • Ammonia

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Rings • Spirals • Coils • Reels
Spools • Sheets • Gaskets
There's a Belmont Packing for every service

MARMADUKE

Continued from page 212

most skill." His audience froze stiff. Each had a perplexed look on his face.

With that, Marmaduke grabbed a bucket from the floor and placed it on a box near a boiler. Then he walked back to the coal bin.

"We'll pitch coal at that bucket," explained Marmaduke. "The first one to get ten lumps inside picks up the prizes on the Chief's desk there." Then Marmy drew a chalk line a few feet in front of the coal bin, about 20 feet from the bucket. To start things off, he grabbed a lump of coal from the bin and tossed it toward the bucket, but missed by a yard.

"OK, boys," croaked Marmaduke, "each man gets three shots at a time. Let's go." Six contestants wobbled up to the line, each listing slightly from over-ballasted tanks. They started selecting lumps of coal. The chief engineer tossed first, but missed all three shots.

Apparently, no one noticed that coal used as missiles was being taken from unweighed fuel and that the target had been placed close to the fast-dwindling pile of weighed coal. All those missed lumps of coal were making the 'pounds combustible' increase by a wide margin. And none of it was recorded. I turned on my heels and headed back to the office.

Yesterday I learned from Bedlam that Marmy made good on his evaporation test. It was by the skin of his teeth —but he did make good. As he told Bedlam, "It took a lot of pitching."

OIL-FILLED BOILER

Continued from page 97

fired boiler was put on the line and pressure came up to normal. Then when things were getting "leveled out" the oil in the boiler was discovered.

Apparently with the steam pressure low, the fireman had opened up wide the oil-supply valve to the bunker-C burners as soon as possible. Oil pressure then topped the atomizing steam pressure at the burner and oil flowed back into the steam line through the partly open check valve into the rear drum. From there it quickly spread through the boiler. Since no steam was getting to the burners, atomization was poor, causing the oily, sooty furnace deposit.

It seems carryover from the drum steam space or close valve clearance had made the check valve bind and stick open. Since no individual check valves had been installed at the burners there was no backup protection. Even

LIKE AN ATOM-IC EXPLOSION

Just 1/32" (pinhole size) faucet leak
MUSHROOMS into ATOMIC WASTE
of approximately 95,000 gallons
of water yearly—costing:
$24.14
@ $1.90 per M cubic feet

If a hot water faucet, then (actual) FUEL WASTED heating 95,000 gallons costs approximately:
$88.91 if coal (9879 lbs.)
$91.08 if oil (702 gals.)
$84.41 if gas (84,411 cu. ft.)
Above figures authenticated by Hackensack Water Co. and American Gas Association.

STOP this needless WASTE during today's MATERIAL and MANPOWER shortages with 'SEXAUER' "Easy-Tites" that outwear ordinary faucet washers 6-to-1, thus SAVING labor on 5 REPEAT repairs, PLUS water and fuel, while prolonging the life of SCARCE fixtures.

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FAUCET WASHERS

...a modern laboratory triumph, are compounded from du PONT NEOPRENE (tested up to 300°F.) instead of rubber—to withstand DESTRUCTIVE HEAT common in present-day super-heating water systems—that formerly broke down washer's structure.

Built like a tire with fabric re-inforcement they resist the grinding, closing squeeze that SPLIT and MUSH ordinary washers out of shape...causing LEAKS.

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Edition G just out, pictures over 2500 TRIPLE-WEAR plumbing REPAIR parts and Pat'd. Precision Tools. It's today's accepted buying guide for dependable purchasing and maintenance personnel among thousands of top PLANTS, INSTITUTIONS and GOVT. AGENCIES that rely on SEXAUER repair materials. Send for your copy today!

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How G.E. washes away lamp troubles with Elgin Ultra-Deionized water

As A development of General Electric's constant research to manufacture better and better fluorescent lamps, a significant finding was the need for absolutely pure water . . . in processes designed to make the best in fluorescent lamps.

To prevent imperfections which could impair efficiency and shorten lamp life, it was found that water must be equal to the best distilled water.

Distilled water might have served, but its cost would be prohibitive. So G-E Lamp Research looked for water of equal quality at justifiable cost . . . and found the answer in Elgin Ultra-Deionized water. In fact they found a water that for this purpose is *better* than distilled water. Where other high quality waters were not quite good enough, Elgin Ultra-Deionized water met the requirement remarkably well . . . and at a fraction of the cost of distilled water.

So here you have another striking example of a difficult water problem solved by Elgin. The same experience and knowledge that solved it is ready to give you the answer to your problem . . . from simplest to most complex. Write for bulletins or let an Elgin engineer work with you.

ELGIN SOFTENER CORPORATION • 130 N. GROVE AVE., ELGIN, ILL.

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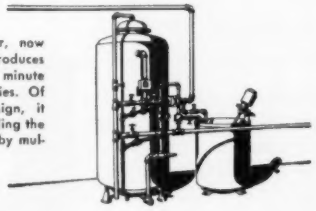
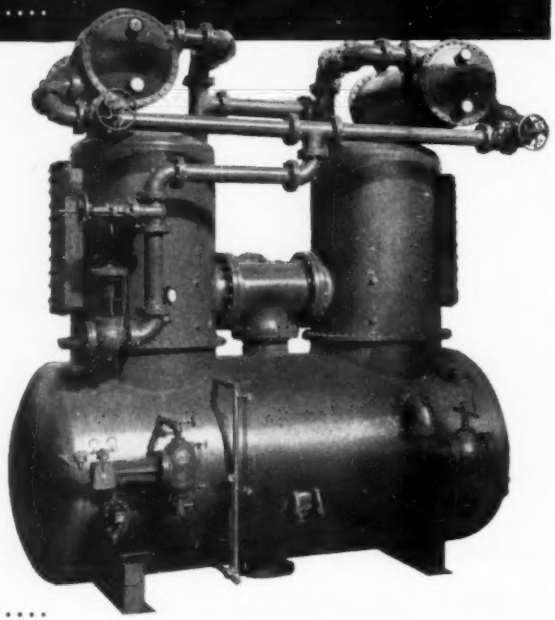
WATER CONDITIONING FOR EVERY NEED



This Elgin Ultra-Deionizer, now used in G-E lamp plants, produces water free from the most minute trace of mineral impurities. Of compact, single-tank design, it produces water far exceeding the quality of that produced by multiple-tank equipment.

12-Ton Cost-Cutter!



Large or small, Stickle Feed-Water Heaters save you real money!

Building the big equipment—*designed for big savings*—is one of the Stickle Steam specialties. Take the example above—a new Stickle Dual-Type Deaerating Heater. Weighing in at 24,000 lbs., this giant heater has a normal capacity of 250,000 lbs. per hour, with only .005 oxygen content retained in the water. Capacity may be easily increased to 300,000 lbs. There is storage space for 250 cu. ft. (15,000 lbs.) of heated water. Total capacity is 10,000 BHP. This is the fourth Stickle Heater specified by a well-known consulting engineer for the West Coast lumber industry.

Large or small, Stickle Heaters—in capacities from 3,000 to 300,000 lbs.—cut your fuel costs 10-15%. MINIMUM RESULTS GUARANTEED FOR EVERY INSTALLATION. Specify Stickle—*know* what to expect! Write for free bulletin below.

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Stickle Equipment

Cuts the cost of steam

OIL-FILLED BOILER

Continued from page 214

then it took a combination of prolonged low steam pressure and wide open oil valve to give the right circumstances under which oil flowed into the boiler.

You may be sure that the atomizing-steam-line check valves were all cleaned up thereafter. Boiler-water conditioning was improved to reduce carryover. Individual check valves were also installed in steam and oil lines to each burner and the setting of the oil-system relief valve was lowered a few pounds to give more margin between oil and steam pressures. You might say this was locking the barn door after the horse was stolen—but a wise man learns from experience!

GUILTY OF REGULITIS?

Continued from page 134

5. *For remainder of test, leave voltage regulator settings alone.*

6. Remove kw load from unit tested by adjusting governors of *other* units.

7. Remove reactive kva load from unit tested by adjusting manual field rheostats of *other* units.

8. If plant load should increase or decrease during test, adjust governor settings and manual rheostat settings of units *not* being tested.

9. Make marks on governor and voltage regulator, adjusting mechanisms so original settings can be duplicated whenever desired.

10. While similarly testing other units, governor of first unit tested may have to be adjusted. If so, do not change its voltage regulator setting as it won't be working. Instead, its alternator will be rheostat controlled, manually.

11. By the procedure given in the first testing method, check speed droop and voltage droop of each unit and make changes to bring droop for all units operated in parallel to same value . . . in the range of 2 to 5%.

After making these adjustments and putting units back on line, governor settings may have to be changed occasionally (if very accurate frequency is desired). Still, do *not* change the voltage regulator settings.

Voltage regulators should be left in complete control of voltage and reactive load division. Accept gracefully the fact that regulators *will* allow some voltage droop as the load increases. Accept, also, the fact that they *will not* divide reactive load evenly under light load conditions. These variations aren't important. The important thing is . . . leave the regulators alone. There's just no excuse for regulitis.

HAGAN Compensated Ring Balance Meters

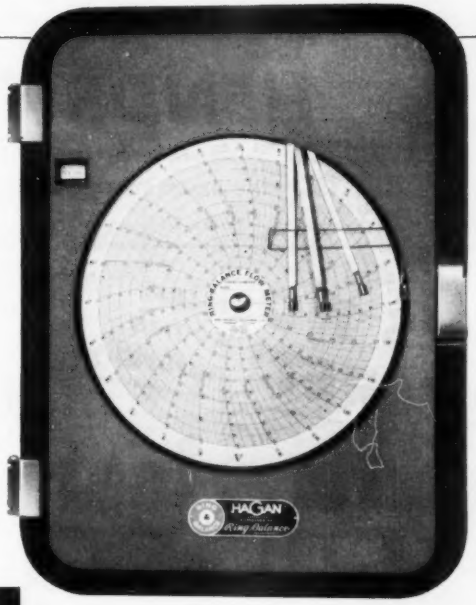
provide *accurate, automatic* compensation

- for *temperature*
- for *pressure* or
- for *pressure and temperature*

When you measure flow of liquids or gases, and pressure and temperature variations occur, there are two ways to correct meter readings — one by expensive and laborious clerical calculations, the other, by using the Hagan Compensated Ring Balance Meter in the first place. This Hagan Compensated Meter corrects *automatically* for variations in pressure, temperature, or pressure and temperature, and makes a chart record of both the corrected and the uncorrected flow. The built-in integrator totalizes the corrected flow automatically.

Dependable Hagan Ring Balance Meters are simple, ruggedly built, and designed for years of trouble-free service. Some features of Hagan Ring Balance Meters include:

- **Mercury level not critical**
- **Ease of dead-weight calibration**
- **No stuffing boxes or pressure-tight bearings**
- **High sensitivity at low flow rates**
- **Adjustable, full-scale range**



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Please send me further information on Hagan Ring Balance Meters. I am particularly interested in _____

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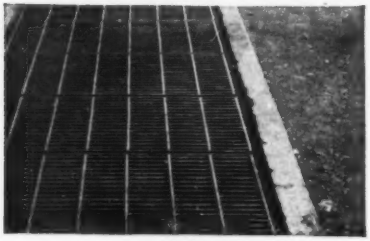
P-6

Hendrick Heavy-duty Grating...



has wide range of usefulness

withstands weight of heaviest trucking, inside or outside of industrial plants . . . excellent for drainage applications . . . for coal grizzlies . . . and wherever it is necessary to sustain unusually heavy loading.

In prominent steel casting plant, Hendrick heavy-duty grating used for breakout floors has paid for itself many times over in reclaimed sand.

Bearing bars range in size from 2¼" x ⅜" to 4" x ⅜"; cross bars from 2" x 5/16" to 2½" x 5/16"; to meet requirements of loading conditions. Write for complete specifications.

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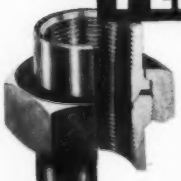
GROUND & POLISHED SEATS REQUIRE NO PACKING!



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a type for every use . . . all temperatures, all pressures!

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206 MILL ST. CATAWISSA, PENNA.

COAL AND ASH HANDLING

Continued from page 99

handy to receive the sluiced ash, you go to the extra expense of decanting tanks—usually a prohibitive step.

Fig. 2 (National Conveyors Co, Inc) shows a pneumatic system with intake for bottom ash directly in front of boiler on the operating floor. (Fig. 6 shows actual ash intake grids in front of another installation.) You rake ash over the grid and it falls into the path of a moving air stream that delivers it to an ash receiver or storage tank. This same system in Fig. 2 pulls out flyash from dust collectors. If ash hoppers are in the basement, provide automatic gravity feed to disposal-system inlets, to avoid an extra man.

Air flow in the normal disposal system depends on the operation of a steam-jet ejector, which incidentally is located beyond the ash receiver to avoid steam mixing with the ash and causing freezing troubles in the storage bin. Ash receiver (simply a cyclone separator) and air washer atop the storage bin removes ash from the air stream. A secondary collector is often used after the ash receiver, and sometimes the discharge from ash receiver pipes directly to the stack. It all depends on how much flyash you handle.

Still another refinement is the rotary ash conditioner large plants use at bottom of an ash-storage bin to wet down ash before dumping to trucks. Simple water sprays on the discharge chute are adequate for most plants consuming less than 25,000 tons of coal annually.

Small plants get by for an erected cost of $12,000 by using a steel ash bin, 5- or 6-in. conveying pipe and, of course, no ash conditioner. Another $4000 or $5000 buys the elaborate system in plants burning 20,000 tons per yr.

WITH OUR READERS

Continued from page 55

you mentioned. I think it's a very clever idea. It will certainly attract more attention than the simple layout that was used before. The content of George Edwards' *letters was always good but the page layout wasn't eyecatching as the new one is. The series should go well . . .*

"As to the use we make of POWER, *we get three copies here: one goes to me, one to the plant engineer, and one to the company. After reading, I put mine in the engine room for the operators and my maintenance gang, and the plant engineer puts his in the rack for his maintenance crew. The third copy stays in the office bookcase for reference. We all enjoy* POWER *very much and the 'How to' page is usually posted on the bulletin board in the machine shop, as are other special items that will help the men. . . ."*

Davis Wharf, Va. DICK GODFREY

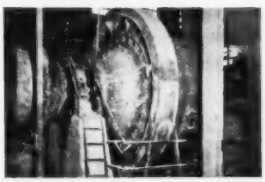
IN ALL INDUSTRIES

LUBRIPLATE LUBRICANTS

EXCEL IN REDUCING FRICTION, WEAR, UPKEEP-COSTS AND POWER-CONSUMPTION...WITH BETTER MACHINE PERFORMANCE

"LUBRIPLATE NO. 630-AA is practically a universal lubricant"

– so writes the SPOKANE PORTLAND CEMENT CO. of Irwin, Wash.



"With the introduction of LUBRIPLATE No. 630-AA, we were able to reduce our requirements so that today we are satisfying all our needs for solid type lubricants with only two LUBRIPLATE Products. LUBRIPLATE No. 630-AA might almost be considered a Universal Lubricant. Furthermore, it has effected a marked savings in lubricants and labor."

Frank D. Neill
General Superintendent

LYNCH CORPORATION of Toledo, Ohio, a leading manufacturer of packaging machinery

says:

"THIS LUBRICANT REDUCES SERVICE CALLS"

"The majority of our machines are used in places where it is necessary to wash them with steam and hot water after each day's use. This naturally would remove any ordinary lubricant and trouble would develop if the machines were not immediately relubricated. With LUBRIPLATE there is always a film left on the machine after washing. Our Service Engineers can readily spot machines that have had other than LUBRIPLATE Lubrication, as these machines do not give the service they should."

"THIS LUBRICANT SAVES 7 TIMES ITS COST IN PRODUCING SHOES" – says WOLVERINE SHOE AND TANNING CORP.

"You recommended to us LUBRIPLATE No. 100 for lubricating the chain drive on our paddle wheels which turn the hides immersed in a solution in concrete vats. The chain during use is always soaked in a solution that is sometimes acid and sometimes caustic. Up to that time we had not found any lubricant that would stay on the chains for any appreciable time. The average life of a chain was approximately one year. Since we have applied LUBRIPLATE to these chains every two weeks for two years, not one chain has required replacement, and they are still going strong.

"At this time it appears that for every dollar we have invested in LUBRIPLATE, we have saved seven dollars in chains."

REGARDLESS OF TYPE AND SIZE OF YOUR MACHINERY LUBRIPLATE LUBRICANTS IMPROVE OPERATION AND GREATLY REDUCE MAINTENANCE COSTS.

Write today for LUBRIPLATE Data Book No. 1-52

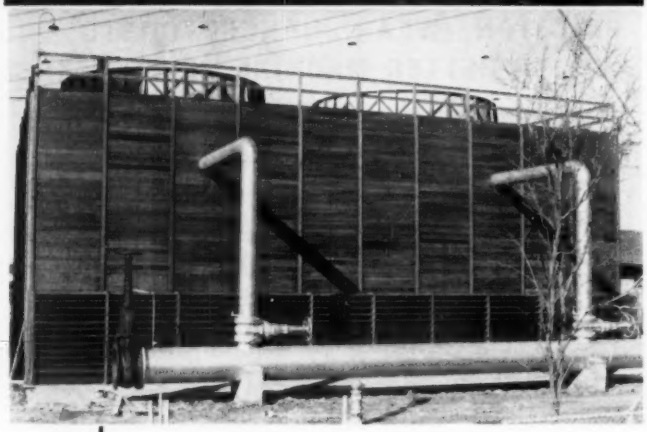
LUBRIPLATE DIVISION
Fiske Brothers Refining Co.
Newark 5, N. J. Toledo 5, Ohio

DEALERS FROM COAST TO COAST—SEE YOUR CLASSIFIED TELEPHONE BOOK

Another Dependable

UNITED

Steam Plant Installation



● A 10,000 gallon, low head induced draft tower of durable redwood recently built for a municipal power plant.

One of many substantial United towers now serving industry in all sections, under a wide variety of atmospheric conditions.

Others in power, petroleum and air conditioning service. Also 3 to 30 ton package type refrigeration units.

Write for Bulletin No. 50. Get United plans and prices before you buy.

UNITED COOLING TOWER CO.

Authorized Representatives in Principal Cities

Porter Building Kansas City 2, Missouri

UNITED

COOLING TOWERS

ANION-EXCHANGE RESINS

Continued from page 109

tion of waste regenerant would be withdrawn through the buried manifold and remainder be taken from the bottom. In this way only relatively sulfate and carbonate-free salt would be in contact with the IR-120 and precipitation would be avoided.

Expected Results. When it comes to figuring expected results, calculations have to be based on a particular exchange resin. So we have used our own IRA-410 and IR-120 to treat a water of this analysis:

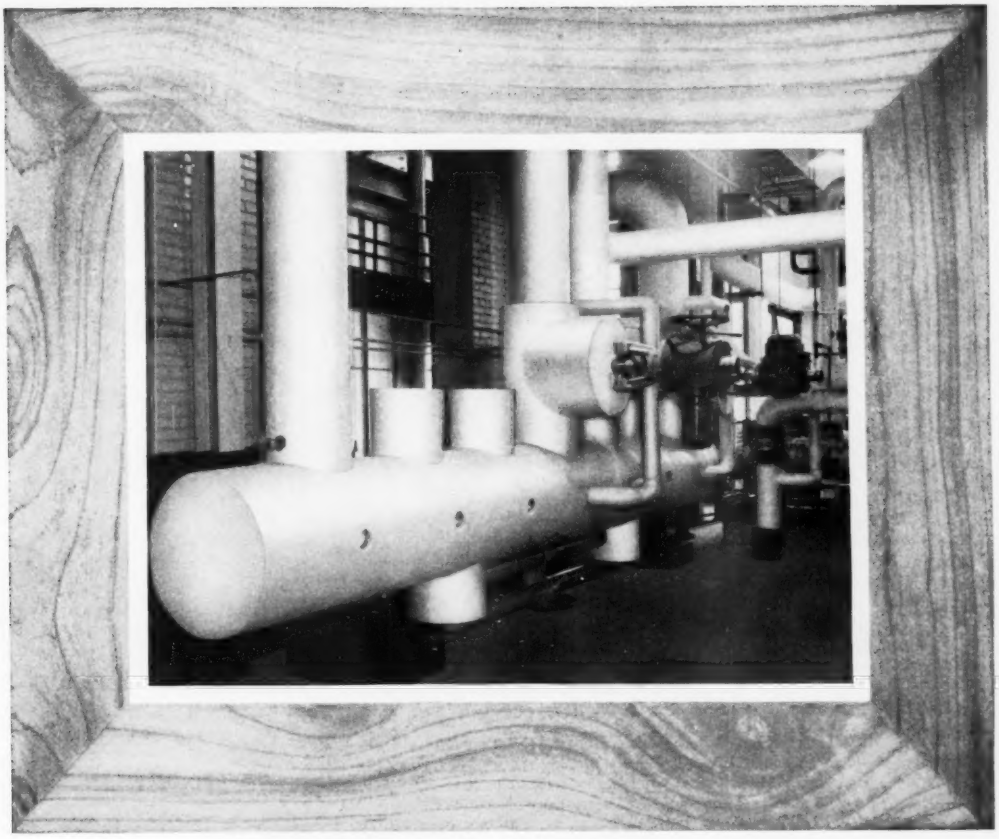
As $CaCO_3$—	*Ppm*	*Gr per gal*
Alkalinity	206	12.1
Sulfates, chlorides	77	4.5
Total hardness	245	14.3
Total anions	283	16.6
Alkalinity (anion ratio total)	0.73	—

If you only want to reduce alkalinity, IRA-410 is the resin to use. Fig. 3 shows alkalinity exchange capacity, for the water under test, required 5.7 kilograins as $CaCO_3$ per cu ft at 4 lb NaCl per cu ft for negligible alkalinity leakage. If a leakage of 4% alkalinity (8 ppm bicarbonate as calcium carbonate) is acceptable, only 3 lb NaCl per cu ft need be used and an alkalinity exchange capacity of 5.0 kilograins per cu ft can be expected. Under these conditions each cubic foot of IRA-410 treats 414 gal of water.

Suppose you want to both dealkalize and soften? Use a three to one ratio of anion resin (Amberlite IRA-410) to cation-exchange resin (IR-120). Exchange capacity of the anionic resin fixes the total combined capacity of the two resins. With the test water reported above, 0.75 cu ft of IRA-410 provided 3.75 kilograins of alkalinity capacity with 2.25 lb of regenerative salt. Using 2.25 lb of salt with 0.25 cu ft of IR-120 develops a hardness-exchange capacity of about 6 kilograins as $CaCO_3$, more than enough for proper treatment of the test water.

From this experience, unit should soften and dealkalize about 310 gal of water for each combined cu ft of resin. This treated water would have a zero hardness, contains about 8-ppm alkalinity and have pH between 5.5 and 6.5 up to the break-through endpoint of 20-ppm alkalinity as $CaCO_3$. With salt at 1c a lb, treatment of this water runs about 7.3c per 1000 gal.

Tide Water Power Co. plans early construction of its 150,000-kw steam-electric generating plant near Wilmington, N. C. The first of three units is expected to go into service in 1954, and the second by 1956.



Insulation Contractor: Guy M. Beaty & Co., Charlotte, N.C.

Steam header at Cannon Mills Co., Kannapolis, N.C., insulated with K&M Hy-Temp and "Featherweight" 85% Magnesia Combination, finished with sewed canvas jacket.

PORTRAIT OF STEAM HEADER AT 750° F.

clothed for life . . . . with K&M Insulations

YOU SEE here one of the most efficient combinations you can get today for lifetime protection against heat loss—K&M Hy-Temp Insulation teamed up with "Featherweight" 85% Magnesia.

You can use the same combination, in appropriate thicknesses, for efficient insulation of temperatures from 600° F. up to 1900° F.

K&M Hy-Temp Insulation is applied directly to the high temperature surface in sufficient thickness to lower the temperature of the outer surface of the insulation to 600° F. or less. "Featherweight" 85% Magnesia, which has a higher insulating value, is then applied directly over the Hy-Temp Insulation, thus utilizing the advantages of both insulations to the fullest extent.

These insulations are supplied in appropriate forms and thicknesses for application to equipment surfaces and piping.

Your local K&M distributor, who is an experienced applicator, will give you full information. Or write us direct . . . we'll rush a reply.

Nature made Asbestos . . .

Keasbey & Mattison has made it serve mankind since 1873

KEASBEY & MATTISON

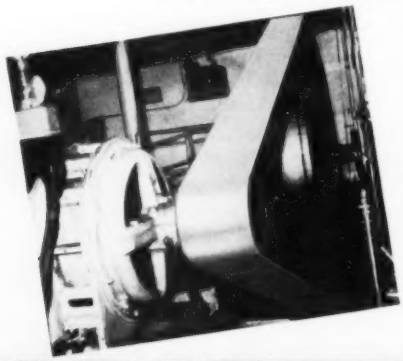
COMPANY • AMBLER • PENNSYLVANIA

In Canada: Atlas Asbestos Co., Ltd., Montreal, Toronto, Winnipeg and Vancouver.

Unusual "Tanning"

MAKES H.P. BEHAVE!

In flat leather belting, for instance, Rhoads special tanning processes produce "custom-engineered" Tannate Belting . . . which consistently delivers maximum horsepower. Tannate also minimizes wear on motor and bearings . . . because of its self-adjusting elasticity and its uniform grip across and around the face of the pulley. Because of these and other desirable characteristics, Rhoads Tannate Belting will out-pull and out-last other good belts. Ask your Rhoads sales engineer for details, or write J. E. Rhoads & Sons, 35 North Sixth Street, Philadelphia 6, Pa.



Shown here is a Tannate Uni-Pull drive installed on a refrigerating compressor. The plant engineer in charge claims this Tannate drive increased the efficiency of the machine at least 33%.

250

J. E. RHOADS & SONS
PHILADELPHIA • NEW YORK
CHICAGO • ATLANTA

YEARS PRODUCING FINE LEATHERS

My Biggest Boner

► When I started working with ac equipment someone said to me "Don't take anything for granted." I heard what the man said, but it must have gone through my head fast because I didn't remember it when I should have.

We bought three second-hand transformers from a war plant. Their nameplates were nice and shiny so I hooked all three into the plant system without further ado. Tie-in was complicated and we were all happy when the new jobs were ready to go.

I switched them into the system and whammy—the whole plant shut down. We had almost a complete dead short so violent it blew the oil tank of a 3000-amp switch off its mountings.

We made a fast check of the transformers, but couldn't find a fault. Pulling cores and checking them and the windings didn't show any trouble either.

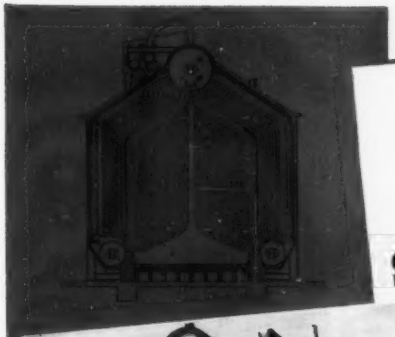
It was then I decided to make a ratio check of the transformers. This showed the trouble. The shiny nameplates said transformer ratio was 3:1. Ratio check showed windings had been reconnected 15:1. We wanted 2200 v on low side; instead we got 440 v.

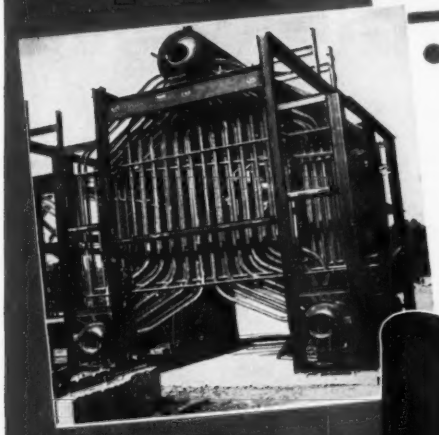
So don't ever take anything for granted, not even dope on a bright nameplate. Make a ratio check. All you need is a voltmeter.

Martin G Lane
Richmond, Va.

• What is your "biggest boner"? We'll pay ten dollars for each one we publish.

UNION
"H" TYPE
STEAM GENERATOR





• The Ideal Outdoor Unit . . .

THESE photos tell their own story of the adaptability of the Union "H" Type Steam Generator . . . the Ideal Outdoor Installation.

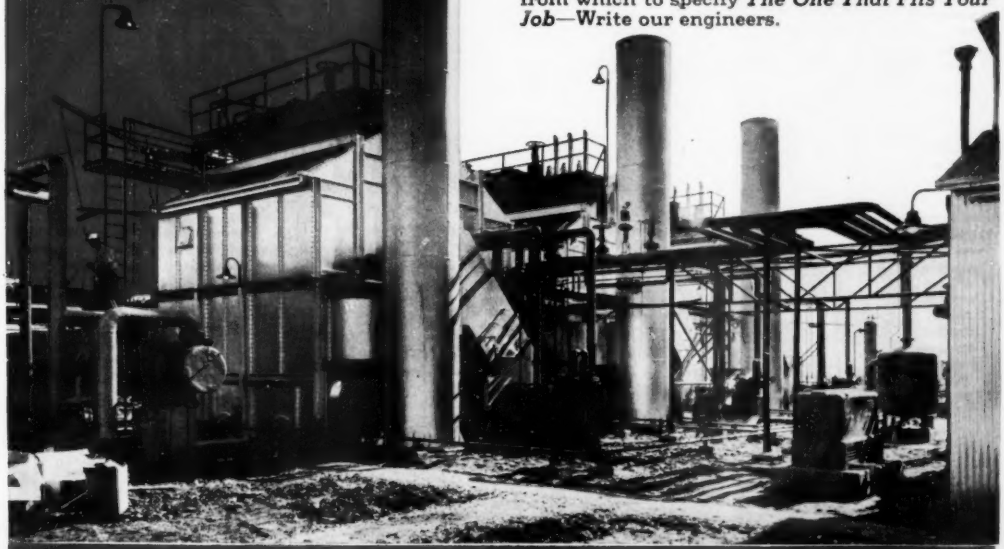
❶ Compact, simplified design in a steel clad insulated setting with furnace inside the unit.

❷ Drum and tube arrangement symmetrical . . . a tube bank on each side forming an integral water cooled furnace. No headers . . . No handhole plates required.

❸ Superheater on one side only provides (patented) simplified superheat control over a wide load range for all fuels and varying excess air. Automatic adjustment of boiler outlet dampers controls gas flow across superheater.

❹ Design accommodates any fuel or firing method for any desired capacity or pressure.

There are 13 basic Union boiler designs from which to specify *The One That Fits Your Job*—Write our engineers.



UNION IRON WORKS . . . *Since 1890*

373 CASCADE STREET • ERIE, PENNA.

BOILERS • PROCESS EQUIPMENT • FABRICATED STEEL

Two Stage CRUSHING IN ONE MACHINE!

The GUNDLACH "Two Stage" Coal Crusher incorporates two crushing stages in one machine and is designed to reduce RUN-OF-MINE to STOKER COAL in ONE operation. Compact design simplifies structural supports and installation. Rugged simple construction combined with engineering proved in the field makes this machine a profitable and reliable unit.

Fulfilling an urgent need in the industry, the GUNDLACH "Two Stage" Crusher has delivered over 85% usable stoker coal from an Illinois mine run lot.

MATERIAL SIZE CAN BE CHANGED WHILE MACHINE IS RUNNING

All Gundlach Crushers are equipped with Gundlach Patented Crushing rollers. (Pat. No. 2578540)

Crusher is pictured without hopper and sprocket guards, but is delivered complete.

TWO STAGE — DOUBLE ADJUSTMENT

T. J. GUNDLACH Machine Co., Belleville, Ill.

WRITE TODAY FOR CRUSHER BULLETIN P-3

BOOKSHELF

The Conservation of Ground Water. *By Harold E Thomas, U.S. Geological Survey, book sponsored by The Conservation Foundation. 327 pp, 9x6 in., $5. McGraw-Hill Book Co, 330 W 42nd St, New York 36, N. Y.*

This book brings together and analyzes available information on the present development and use of ground water throughout the U.S. Engineers concerned with ground water supply will find a summary discussion of natural and legal factors governing this field throughout the country.

Basic hydrologic principles and data together with broad-gage inventory of our total water resources are included in the discussion. Measures which have been or could be undertaken to improve supply problems are reviewed for more than 70 areas. The author analyzes problems resulting from: pumping, settlement and use of land, irrigation and drainage operations, disposal of wastes, etc.

More effective ground-water development and better management of this resource are urgently needed in the U.S. A series of maps shows the ground-water situation over the country including areas of over-draft, salt-water intrusion and others.

Industrial Heat Transfer. *By F W Hutchinson, professor of mechanical engineering, University of California. 326 pp, 9¼x6¼ in., $6. The Industrial Press, 148 Lafayette St, New York 13, N. Y.*

A unique presentation of practical physical data in the form of a collection of calculating charts. The book presents and discusses equations finding the widest industrial application and analyzes their use. Each equation then can be solved by using the graphical chart associated with it.

Because of the arithmetical complexity of many of the heat transfer equations, the charts prove to be helpful timesavers. Each subject of heat transfer—conduction, radiation, convection, forced convection and combined methods—has an introductory section primarily for student use. Practicing engineers need not refer to these sections but will find each chart with accompanying explanation ready for their use. Although these charts are no larger than book page size, the author states that the graphs equal in accuracy the equations on which they are based.

The Technique of Clear Writing *(1952) By Robert Gunning. 289 pp, $3.50. McGraw-Hill Book Co, 330 W 42nd St, New York 36, N. Y.*

Here's help for the engineer anxious to write better letters, reports and articles. Since 1944, Robert Gunning Associates have counseled newspapers, magazines and industrial firms on readability. In this new book, Gunning boils down this wide experience into practical pointers for the individual writer. He tells why most writing is hard to read, shows how readability can be measured by the writer himself.

Then he lists ten principles of clear

Now you can have

Performance Rated

Air Filters

- **FAR-AIR*** *originates*
- *greatly improved*
- *testing methods that*
- *take the guesswork out*
- *of air filtration!*

All architects, engineers and reputable filter manufacturers know this important fact about air filters: *no filter—regardless of its design—operates at equal efficiency under all dust conditions.* For example, a filter may stop "gravel" with 100% efficiency, but may have 1% efficiency when exposed to dust particles of 0 to 5 micron size. (1 micron—1/25,000 inch.) The new FAR-AIR testing methods accurately rate filter efficiencies under *all* dust conditions—not just one set of laboratory conditions using a "standard" test dust, as in the past.

THIS IS IMPORTANT TO YOU because, for the first time, you can buy air filters whose performance rating under your operating conditions is accurately determined in advance. No more guesswork when you buy FAR-AIR filters! You may also save needless expense by installing the type filters that are no more efficient than necessary to meet the requirements of the job.

This tremendous advancement in the science of air filtration is ready to serve you now. Your nearby Farr Field Engineer can be of valuable assistance in solving your air filtration problems. Why not call him today?

Write today for your copy of the free booklet on the new Farr testing procedures, which gives full technical information on the equipment used in these tests and the results obtained. Address: Farr Company, P.O. Box 10187, Airport Station, Los Angeles 45, Calif.

FAR-AIR FILTERS

"Better by Farr"

FARR COMPANY

Manufacturing Engineers

Los Angeles • Chicago • New York

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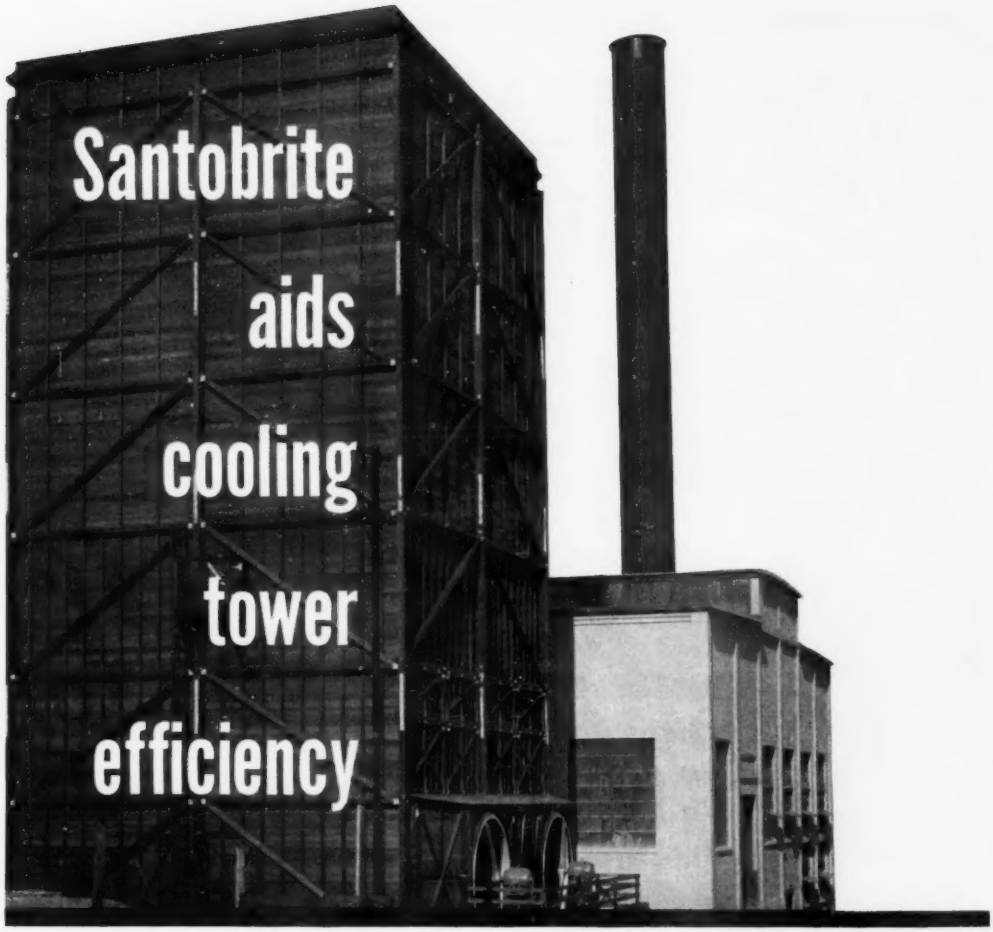

Your cooling towers will be more efficient . . . and maintenance costs will be lowered . . . by the elimination of slime and algae. Monsanto Santobrite, in years of service, has proved its effectiveness and economy.

Five to 10 parts per million, at 25-35° C. and at pH of around 7.0, will kill siliceous algae. Five to 15 parts per million destroys green algae. Blue-green algae are eliminated with 10 to 20 parts per million of Santobrite.

Santobrite (sodium pentachlorophenate, technical) is water soluble. It can be applied easily and without expensive special equipment. Santobrite is available in powder, pellet and briquette form.

For information on the use of Santobrite to cut down cooling tower operating costs while stepping up efficiency, contact the nearest Monsanto Sales Office or write MONSANTO CHEMICAL COMPANY, Organic Chemicals Division, 1700 So. Second Street, St. Louis 4, Missouri.

Santobrite: Reg. U. S. Pat. Off.

DISTRICT SALES OFFICES: Birmingham, Boston, Charlotte, Chicago, Cincinnati, Cleveland, Detroit, Houston, Los Angeles, New York, Philadelphia, Portland, Ore., San Francisco, Seattle. In Canada, Monsanto Canada Limited, Montreal.

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CHEMICALS – PLASTICS

SERVING INDUSTRY...WHICH SERVES MANKIND

NEW STEAM METER

BUILDERS 1952 MODEL SHUNTFLO METER

— For STEAM, AIR or GAS

Gives you answers to steam consumption in POUNDS, not GUESSES.

FEATURES

- New streamline cooling and damping chamber
- Improved durability and ruggedness for longer service
- No stuffing box to leak or cause friction
- High accuracy over wide range, within ± 2% of actual flow
- "Open upper limit", temporary overload capacity of 150%
- Self-contained and self-operated
- As easy to install as a valve or fitting

Builders Shuntflo Steam Meters are available in two styles: Model SMKS for 2" to 14" lines — Model SMDH for 1" and 1½" lines. Send for descriptive Bulletins 400-FI and 400-F2. Builders-Providence, Inc. (Division of Builders Iron Foundry), 354 Harris Ave., Providence 1, Rhode Island.

BUILDERS PROVIDENCE *Instruments*

Instruments for recording, indicating, and controlling flow, liquid level, pressure, and weight. Chlorinizers — chlorine gas feeders.

More BOOKSHELF

Begins on page 224

writing, shows how they can be applied in everyday writing of all kinds. He winds up by giving special hints for businessmen, lawyers, engineers. Useful appendices show how a readability analysis is made, list 3000 most familiar words, line up short synonyms for overworked long words.

Writing is one of the most important engineering operations. Ability to write clearly will add many thousands of dollars to an engineer's life income. In this book, Gunning has given an interesting, practical guide for the man who wants to improve in this direction.

Water Treatment for Industrial and Other Uses. *By Eskel Nordell, administrator, analytical laboratories, research and pilot plant div, Permutit Co. 525 pp, 6¼ x 9¼ in., illust, cloth, $10. Reinhold Publishing Corp, New York 36, N. Y.*

The value and importance of water treatment for industrial and commercial use have grown so vast that there is a strong need for a comprehensive and authoritative text on this subject.

This book is an answer to that need. It approaches the problem by describing the uses of water in different process industries and then delves into the types of water impurities—chemical compounds, suspended solids, color, taste. The methods for removal of these different impurities follows.

All in all this book serves as helpful, practical guide to anyone interested in water treatment problems.

Heating, Ventilating and Air Conditioning Guide *(1952 edition) Prepared by the Guide Committee, ASHVE. 1520 pp, 6¼ x 9¼ in., illust, many tables, catalog section, $7.50. American Society of Heating and Ventilating Engineers, 62 Worth St, New York 13, N. Y.*

The *Guide* is pretty much the bible of the heating, ventilating and air conditioning industry. It covers technical and design data in 50 subjects of direct interest to this industry, so you can appreciate this publication's position in the field. Data has been reviewed and revised throughout, and there are 32 pages more than last year.

New codes of interest and late additions to all codes make up the enlarged list of codes and standards. Further, names and addresses of organizations that can supply these codes and standards are listed.

A special feature, its catalog of 277 manufacturers and their products, has been indexed according to various categories.

To insure that Navy fighting planes will obtain flight ceilings higher than those of any enemy aircrafts, the **Navy's Bureau of Yards and Docks** is speeding the completion of a new aeronautical turbine laboratory at Trenton, N. J. specifically designed to test Navy jet engines. The aeronautical turbine lab will consist primarily of five testing chambers composed of two altitude "strato-chambers," two test cells and one turboprop cell incorporating the latest design techniques by **York Corp.**

ANCHOR VY/FLEX

A Flexible Metallic Packing That Withstands High Pressures and High Temperatures

Modern power operated machines have created a demand for packings capable of giving service on greater pressures and temperatures than ever encountered. To meet this need, Anchor developed Vy/Flex, a highly specialized packing. It withstands operating elements where many other packings have failed.

Anchor Vy/Flex packing is furnished in pre-formed ring sets only and should be used preferably in the Ankor-Nest construction. However, it is available in rings of square cross section—endless or split, as ordered.

Adaptable to use in power plants and steel mills, on railroads, in chemical plants, on throttle valves, reducing valves, header and hot blast valves, in oil refineries, and on air compressors, expansion joints, high temperature gases, asphalt and acid pumps, tar and water column gaskets. For full data write today.

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FIBROUS AND METALLIC PACKINGS FOR EVERY INDUSTRIAL PURPOSE

In a Midwestern power company ash handling installation this 8" pump shell of ABK Metal outlasted an alloy steel casting by 2½ to 1.

CUT YOUR ASH HANDLING COSTS

with ABK METAL

Its rugged resistance to abrasion means longer life — fewer replacements of parts and equipment.

For handling wet or dry ashes ABK Metal greatly lengthens the service life of ash pump casings and impellers, ash pipes, elbows and fittings, sluiceway liners, fly ash injector nozzles, wear backs and similar equipment. ABK Metal has outlasted white iron and manganese steel which it replaced, by as much as 7 to 1.

ABK Metal is a nickel-chrome iron alloy of controlled structure that will outlast and outwear any cast abrasion-resistant material under almost all conditions of service. Over a period of years it has established an unmatched record for economy and long wear under the most severe abrasive conditions.

Don't let ABRASION steal your power-economy dollars . . .

SPECIFY ABK METAL

ABK METAL fights ABRASION

AMERICAN Brake Shoe

BRAKE SHOE AND CASTINGS DIVISION
230 Park Avenue, New York 17, N. Y.

More FREE BULLETINS

Begins on page 175

equipment. Specifications, ordering information. Westinghouse Electric Corp, Box 2099, Pittsburgh 30, Pa.

B15 FRACTIONAL HP MOTORS— Open drip-proof and totally-enclosed fan-cooled models, light-weight. New *Form G* line. 16-page booklet GEA-5567 gives description, photos. General Electric Co, Schenectady 5, N. Y.

B16 MOTOR-GENERATORS — Low-voltage, dc units for electrolytic processes. Sleeve- and ball-bearing types. 14-page bulletin 20-210 pictures construction details. Electric Products Co, 1725 Clarkstone Rd, Cleveland 12, Ohio.

B17 INDUCTION MOTORS — *Life-Line*, ac induction units, 20 to 700 hp. 20-page booklet B-4731 shows design and application features, describes construction and mountings. Westinghouse Electric Corp, Box 2099, Pittsburgh 30, Pa.

B18 STANDBY EMERGENCY POWER —Requirements, types available, controls for automatic operation. Article from *E M Synchronizer* No. 35 has diagrams, installation photos, additional articles on turbine-generators. 20 pages. Electric Machinery Mfg Co, 1331 Tyler St NE Minneapolis 13, Minn.

★ **ELECTRONIC PARTS** — Tubes, panel meters, relays, switches, condensers, resistors, etc. 1100-page catalog gives specifications, dimensions, prices for over 75,000 items. ★Write direct on company letterhead. Milo Radio & Electronics Corp, Dept PP, 200 Greenwich St, New York 7, N. Y.

B19 BATTERY CHARGERS — Single-circuit, motor-generator type for industrial batteries. 4-page bulletin 10-210 describes *Type S* line. Photos, specifications. Electric Products Co, 1725 Clarkstone Rd, Cleveland 12, Ohio.

★ **INSULATORS**—*Lava* units made to customer's design. 2 booklets detail properties, grades, thermal resistance, etc. 4-page folder on insulators for electronic tubes; 8-page folder on industrial insulators. ★Write direct to M. Kirchberger & Co, Inc, 1425 37th St, Brooklyn, N. Y.

B20 ELECTRICAL INSULATION — 16 pages of data sheets list leading manufacturers and suppliers of *Class H* components, give specifications for silicone-varnished glass cloth and tape. Reference Nos. G 16-A, B, C, D, and G 20. Dow Corning Corp, Midland, Mich.

MAINTENANCE EQUIPMENT

B21 PIPE TOOLS—Hand and power pipe and bolt machines, rachet threaders, reamers, cutters, etc. 28-page catalog gives complete information, with photos and operating methods. Beaver Pipe Tools, Inc, Dana Ave, Warren, Ohio.

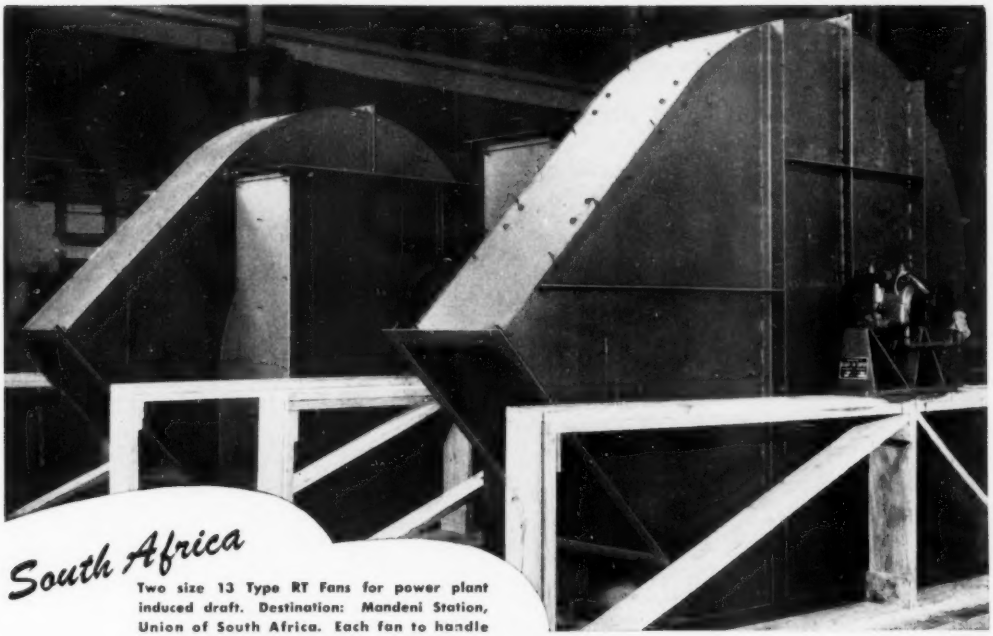
B22 OILERS AND SUPPLY CANS— 10-page catalog 100 gives specifications, capacities of welded steel bench and pump oilers, torches, etc. Gem Mfg Corp, Dept SDP, 1229 Goebel St, Pittsburgh 33, Pa.

B23 MASONRY DRILL BITS — *Cyclo-twist, cyclo-core* and *thunderbolt* bits for soft, hard and very hard materials. 6-page folder gives prices, specifications, guide for choosing right bit. New England Carbide Tool Co, Inc, 60 Brookline St, Cambridge 39, Mass.

B24 CUT-OFF WHEELS — 8-page folder 6921 gives grade recommendations, performance data and operating suggestions for Manhattan cut-off wheels used on machines made by Stone Machy Co. Abrasive Wheel Dept, Manhattan Rubber Div, Raybestos-Manhattan, Inc, Passaic, N. J.

MAINTENANCE MATERIALS

B25 DAYLIGHT CONTROL — Prismatic glass blocks produce better daylight lighting. 24-page booklet *Daylight for Industry* shows principles of good lighting, use of glass block in factory and office. Ray Smolik, Sales



South Africa

Two size 13 Type RT Fans for power plant induced draft. Destination: Mandeni Station, Union of South Africa. Each fan to handle 48,300 c.f.m. of flue gases at over 500° F.

Clarage **HEAVY-DUTY** Induced Draft Fans Travel a Long Way to Make Good

SEND FOR CATALOG 901

Type RT Fan specifications and equipment arrangements for induced draft, forced draft and industrial air handling services are covered in this catalog. Write for your copy today.

Shipped five months ago, these Type RT Fans are now in operation almost halfway around the world from Clarage service . . .

But whether you are 50 miles from us — or 10,000 — makes little difference when you install Type RT fan equipment.

Every RT fan part — wheels, bearings, shaft, housing — is HEAVY-DUTY construction. You are not likely to need repair parts for a long time to come!

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HEADQUARTERS FOR AIR HANDLING & CONDITIONING EQUIPMENT

Clarage Fan Company 615 PORTER STREET **KALAMAZOO, MICH.**

SALES ENGINEERING OFFICES IN ALL PRINCIPAL CITIES

IN CANADA: Canada Fans, Ltd., 4285 Richelieu St., Montreal

EXTRA YEARS OF MORE DEPENDABLE POWER

. . . at less cost per pound of steam

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DUCT WORK—BREECHINGS
ELECTRICAL ENCLOSURES—STACKS
TRANSFORMER HOUSINGS—TANKS
CONTROL DESKS—INSTRUMENT PANELS
CUBICLES—PIPING—CABLE PANS

More FREE BULLETINS

Begins on page 175

Promotion Dept, American Structural Products Co, Ohio Bldg, Toledo, Ohio

B26 **LUBRICANT** — Moly - sulfide is stable from −40 to + 700 F, works effectively where other lubricants have failed. 40-page booklet gives 69 shop and 85 field applications. Climax Molybdenum Co, 500 Fifth Ave, New York 36, N. Y.

B27 **POROUS CHROMIUM** — For lining engine cylinders. 12-page booklet shows applications. *Porus-Krome* method of electrodepositing. 10-page reprint from *ASME Transactions* discusses properties. Van der Horst Corp of America, Olean, N. Y.

B28 **METALLIC COMPOUND**—Can be used to prevent corrosion, or as a sealant, lubricant, or gasket. 8-page folder No 5 gives specifications, uses. 20-page condensed report from Underwriters' Laboratories gives tests and results. James K Harbinson & Co, Inc, 70 W Chippewa St, Buffalo 2, N. Y.

B29 **FLEXIBLE TUBE CABLE** — For air and hydraulic circuits. *Armortube* contains 4, 8, or 12 tubes in flexible metallic covering. 4-page bulletin BA-927 gives specifications, advantages. Bailey Meter Co, 1050 Ivanhoe Rd, Cleveland 10, Ohio.

B30 **COLD SETTING CEMENT**—*Nervacoat Plant* is anti-corrosion waterproof coating for insulation, roofs, decks, walls, etc. Bulletin 403 and technical data sheet give properties and uses. Rubber & Plastics Compound Co, Inc, 30 Rockefeller Plaza, New York 20, N. Y.

B31 **PLANT MAINTENANCE** — *Oakite Plant Maintenance Digest* recommends specific materials and methods for 54 cleaning and related tasks in factories. 16-page bulletin with index. Oakite Products, Inc, 123 Rector St, New York 6, N. Y.

B32 **ROOF COATING** — Asbestos-aluminum coating provides insulating seal, prolongs roof life. 2-page bulletin L-4925 gives features, describes other aluminum paints for other applications. Paramount Industrial Products Co, University Center Station, Cleveland 6, Ohio.

B33 **PROTECTIVE COATINGS** — For controlling corrosion on industrial floors, walls, ceilings, etc. 2-page technical bulletin 501 shows chemical resistances in chart form. G Russell Hersam, Gen Sales Mgr, Prufcoat Laboratories, Inc, 50 E 42nd St, New York 17, N. Y.

B34 **MASONRY PROTECTION**—Coating for concrete, stucco, concrete block, etc. *Dum-dam masonoc* prevents moisture seepage, checks cracks. 20-page bulletin gives applications, photos. Arco Co, 7301 Bessemer Ave, Cleveland 27, Ohio.

MATERIALS HANDLING

B35 **INDUSTRIAL LEATHERS** — Flat and rounded belting. *Tannate* leather packings for hydraulic and pneumatic equipment. File folder contains 11 data sheets with specifications, uses. J E Rhoads & Sons, 35 N 6th St, Philadelphia 6, Pa.

B36 **BELT CONVEYOR** — *Table-veyor* for assembly, inspection, checking, etc. 4-page bulletin TV-52 gives uses, specifications, description. Rapids-Standard Co, Inc, Dept TV, 342 Rapistan Bldg, Grand Rapids 2, Mich.

B37 **CRUSHERS**—Ring and roll types, for reducing coal, coke, lime, glass cullet, etc. 16-page bulletin 12-C gives capacities, power requirements, dimensions, photos, special applications. Stephens-Adamson Mfg Co, Aurora, Ill.

MECHANICAL TRANSMISSION

B38 **BELTING** — Catalog and manual lists belting use, shows how to get longer life, make a belt endless, etc. Power ratings, speeds, specifications, sizes, prices, etc. 40 pages. Graton & Knight Co, 356 Franklin St, Worcester 4, Mass.

EXTRA THICKNESS* in critical areas . . .
LONGER LIFE for alloy piping systems
with KEY-KAST alloy steel welding fittings!

AVAILABLE IN ALL SHAPES . . . SIZES . . . SCHEDULES . . . IN LOW AND INTERMEDIATE ALLOYS AND VARIOUS STAINLESS STEELS.

Check ✓ these PLUS advantages of KEY-KAST welding fittings against *your* alloy fitting needs!

- ✓ Greater wall thickness throughout—for increased structural strength.
- ✓ Greater allowance against corrosion and erosion.
- ✓ Meets A.S.M.E., A.S.T.M. and A.S.A. codes.
- ✓ Lower unit cost.
- ✓ Bosses provided on all fittings for tapped openings.
- ✓ Controlled quality . . . through rigid metallurgical control . . . produced, inspected and tested in one plant.

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. . . NEW Heat Saving Efficiency

MUNDET 85% MAGNESIA INSULATION provides maximum strength and resistance to vibration. Extra durability is built into this insulation. In pipe covering and blocks, it is precision manufactured on the latest type of automatic equipment to insure uniform standards. It does not "powder", settle or disintegrate. It is unaffected by steam or water leakage. It maintains an attractive, smooth finish. Precision pipe fit is assured, with no spaces left for the escape of heat. You benefit from the most modern manufacturing facilities for the production of heat insulation when you specify Mundet 85% Magnesia Pipe Covering and Blocks. *Write for new heat insulation Engineering & Specification Data Manual.*

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Insulation Division, 7107 Tonnelle Ave., North Bergen, N. J.

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DALLAS 10, 601 Second Ave.
DETROIT 23, 14401 Prairie Ave.
HOUSTON 1, Commerce and Palmer Sts.
INDIANAPOLIS 4, 15 E. Washington St.
JACKSONVILLE 6, FLA., 800 E. Bay St.
KANSAS CITY 7, MO., 1401 St. Louis Ave.
KNOXVILLE, 1221 Grand Ave.
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NEW ORLEANS 16, 315-25 N. Front St.
NEW YORK 17, 331 Madison Ave.
PHILADELPHIA 39, 856 N. 40th St.
ST. LOUIS 9, 3176 Brannon Ave.
SAN FRANCISCO 7, 440 Brannon St.

INSULATION FOR HIGH & LOW TEMPERATURE

More FREE BULLETINS

Begins on page 175

B39 SPEED CHANGERS — Miniature preloaded units for use where backlash between high and low speed shafts must be zero or a very low value. 2-page technical data sheet No. 7 has cross-section diagram, shows operation principles. Metron Instrument Co, 432 Lincoln St, Denver 9, Colo.

METALS AND ALLOYS

B40 ALUMINUM BRONZE ALLOYS — *Ampco* metals offer wide range of physical properties with inherent resistance to wear, impact, fatigue, stress, and strain. For bearings, gears, dies, etc. 4-page bulletin G-1 gives properties, suggested uses. Ampco Metal, Inc, 1745 S 38th St, Milwaukee 46, Wis.

B41 MACHINERY PARTS — Cast and wrought alloy parts to solve abrasion, corrosion, and high-temperature problems. 24-page booklet F-7158 gives dimensions, drawings and alloys for various parts. Haynes Stellite Co, Div of Union Carbide and Carbon Corp, 30 E 42nd St, New York 17.

METERS AND INSTRUMENTS

B42 VARIABLE-AREA FLOW METERS — 40-page handbook 10596 gives meter sizing and calibration prediction data. Describes variable-area meters, tubes and floats, compares them with variable-head meters. Curves, charts, capacities, dimensions. Fischer & Porter Co, Hatboro, Pa.

B43 GAGES — *Magnehelic*, air filter, hook and smoke gages, slack tube manometers pictured and described in 12-page catalog. Ranges and dimensions. F W Dwyer Mfg Co, 317 S Western Ave, Chicago 12, Ill.

B44 SCIENTIFIC EQUIPMENT — *Burrell Announcer* published 6 times a year. Includes feature articles, description of new scientific apparatus. Burrell Corp, 2223 Fifth Ave, Pittsburgh, Pa.

B45 SMOKE DETECTOR — For air conditioning systems. 2-page bulletin AC-2 describes uses, operation. Ess Instrument Co, Bergenfield, N. J.

B46 SMOKE RECORDER—Ess *Hazegage* plus *ElectroniK* recorder measure and record smoke intensity in the stack. 4-page Instrumentation data sheet No. 10.14-4 explains operation, has wiring diagrams. Minneapolis-Honeywell Regulator Co, Brown Instruments Div, Wayne and Windrim Aves, Philadelphia 44, Pa.

B47 SPECIAL - PURPOSE INSTRUMENTS — 8-page bulletin 10A gives basic data on insulation and ground resistance, dielectric strength testing instruments. Brief descriptions of complete line, photos, specifications, detailed bulletins. Associated Research, Inc, 3770 W Belmont Ave, Chicago 18, Ill.

B48 PYROMETERS — Hand units for surface, liquid, gas and molten metal temperatures, 0-1500 F. 2-page bulletin GEC-836 gives specifications, application, operation. General Electric Co, Schenectady 5, N. Y.

B49 CONTINUOUS SAMPLING MONITOR — Simplifies quality control by eliminating 100% inspection. 4-page bulletin GEA-5738 describes operation, installation. General Electric Co, Schenectady 5, N. Y.

B50 TACHOMETERS — Continuously indicating, accuracy to ¼%, ranges 25 to 100,000 rpm. 2-page technical data sheet 42HJK gives speed ranges, specifications. Metron Instrument Co, 432 Lincoln St, Denver 9, Colo.

B51 GAUSS METERS — Also indicating, recording fluxmeters to measure magnetic properties. 12-page bulletin GEC-727 has photos, diagrams, gives features, prices. General Electric Co, Schenectady 5, N. Y.

(*Continued on page 234*)

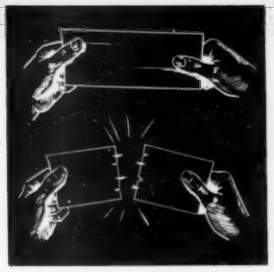
S-E-Co. Coal Scales Are Reliable

S-E-Co. Coal Scales are equipped with an endless feed belt which has no point of weakness. To demonstrate the great strength of an endless belt, try this yourself.

Cut a piece of paper into a strip 3″ wide x 10″ long, pull hard—note its strength.

Now cut two pieces 3″ wide x 5″ long and join them together with staples. Pull this spliced strip just a little and it pulls apart.

Only endless belts have enough strength for reliable coal scale operation. All **S-E-Co.** Coal Scales are equipped with endless belts.



SEND YOUR INQUIRY TO **STOCK EQUIPMENT COMPANY**

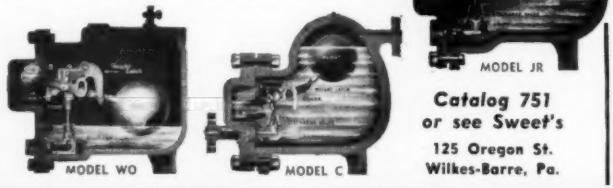
715 C HANNA BUILDING • CLEVELAND 15, OHIO

Nicholson W. O. Traps Are

LEAKPROOF IN SUPER HEAT

Nicholson weight-operated traps will not leak live steam, even though body may become completely dry due to re-evaporation. Unlike most bucket and float traps, Nicholson units do not depend on buoyancy of float to raise valve. Their extremely large orifices also keep valve clean, preventing blow-through. Working parts of stainless steel.

3 TYPES, for every heay-duty use; pressures to 1500 lbs. Also for air and gasoline.



Catalog 751 or see Sweet's

125 Oregon St. Wilkes-Barre, Pa.

W. H. NICHOLSON & CO.

TRAPS · VALVES · FLOATS

THE ANSWER TO ANY HOT WATER PROBLEM!

Pick

INSTANTANEOUS WATER HEATERS

Proved by PERFORMANCE in

STEEL MILLS
TANNERIES
LUMBER MILLS
RAILROADS
FOOD PROCESSING

CONTROLLED TEMPERATURE AT ANY VOLUME

PICK heaters provide hot water INSTANTLY by steam injection. They're entirely automatic to provide and accurately maintain pre-set temperatures. Exclusive Pressurizer Piston eliminates pipe hammering and shaking. Available in sizes and combinations to provide any volume needed. Installation is simple — requires only ordinary pipe connections.

No Storage Tanks Needed
Compact design permits installation in corners, on walls, or overhead.

Easily Cleaned
No coils. Can be cleaned in a matter of minutes — without dismantling.

Write Dept. P-10 for Engineering Details

MANUFACTURED BY
PICK MANUFACTURING CO.
WEST BEND, WISCONSIN, U.S.A.

More FREE BULLETINS

Begins on page 175

PIPING, VALVES FITTINGS AND SPECIALTIES

B52 **EXPANSION JOINTS**—Slip type, with single and double joints. 150 and 300 lb flanged ends. 8-page bulletin 251 has photos, dimensions, thermal expansion curves. The Royalton Co, Inc, Gasport, N. Y.

B53 **SIGHT FLOW INDICATORS**—For checking flow and fluid in pipe lines. Sizes ½ to 4 in, 350 to 50 lb pressure ratings with pyrex. 2-page bulletin has dimensions, photos. Trinity Equipment Corp, 472 Westfield Ave, E, Roselle Park, N. J.

B54 **REGULATING VALVES**—Double-seated diaphragm type for use with control instruments. Sizes ½ to 10 in., 125 to 600 lb. 4-page bulletin 513 has photos, dimensions. Leslie Co, Lyndhurst, N. J.

B55 **WATER AND STEAM VALVES**—Float, altitude, check, reducing, relief, solenoid - operated, non - return types. 8-page bulletin G-3 has photos, sizes, features. Golden Anderson Valve Specialty Co, 2070 Keenan Bldg, Pittsburgh 22, Pa.

B56 **SOLENOID VALVES**—For high-pressure operation in hydraulic systems handling non-corrosive fluids. 8-page bulletin has photos, diagrams, applications. Waterman Engineering Co, 725 Custer Ave, Evanston, Ill.

B57 **BLOW - OFF VALVE** — Rotary disc, continuous *Uniblow* unit insures control of boiler blow-off. 15 calibrated orifices allow changes in flow rate. 4-page bulletin 152 shows construction, method of installation. Uniblow Valve Co, 1920 W 77th St, Cleveland 2, Ohio.

B58 **PIPE HANGERS**—Constant support type in 25 sizes from 2 to 12 in., capacities from 50 lb up. 8-page catalog 511 has diagrams, dimensions, typical arrangements. Bergen Pipesupport Corp, 50 Church St, New York, N. Y.

PRIME MOVERS

B59 **MECHANICAL - DRIVE TURBINES**—Impulse type for steam, gas or air operation. 6 bulletins, No. 4110-A to F. One for each of the 5 types available, from ¼ to 120 hp. Performance charts, construction details, dimensions, selection data. Sixth bulletin has general information. Pyle-National Co, 1334 N Kostner Ave, Chicago 51, Ill.

B60 **DIESEL ENGINES**—4-cycle, 1, 2, and 3-cylinder units for continuous or standby service. 10 to 45 hp, 1200 to 1800 rpm. 12-page bulletin 194 has photos, cross-section view, design features, applications. Nordberg Mfg Co, Milwaukee 1, Wis.

PUMPS

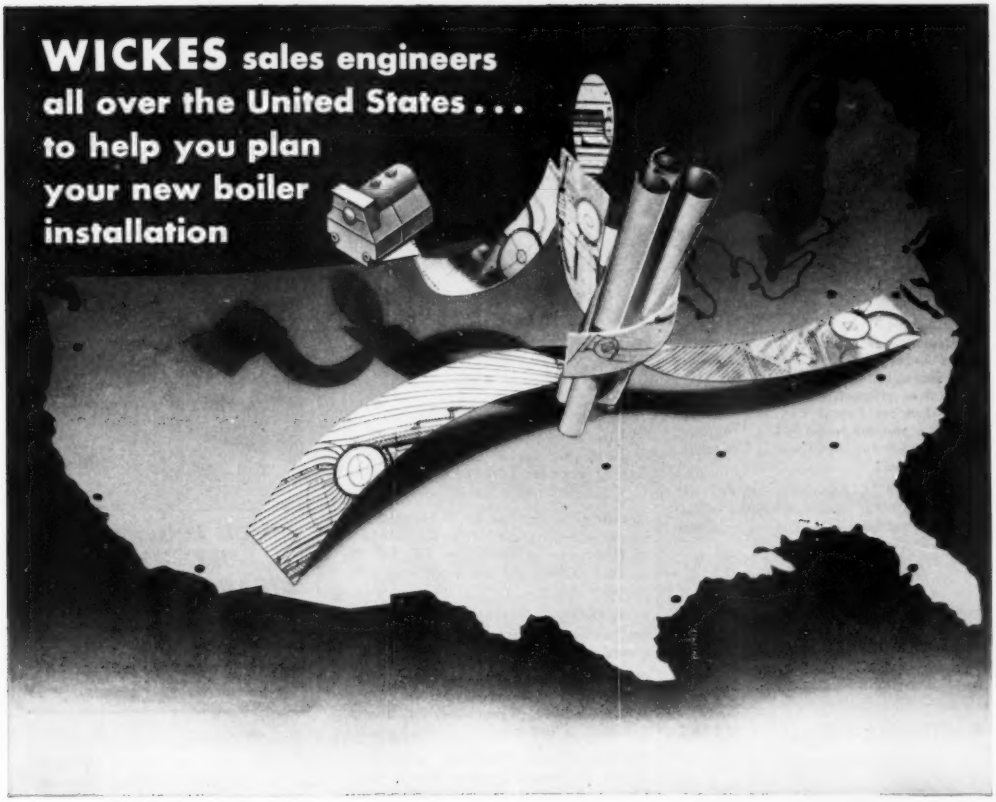
B61 **HI-PRESSURE PUMPS** — 3½ to 60 gpm, pressures to 1000 psi. Small units with 2 cylinders have 2 operating component parts, large 4-cylinder models have 3. 8-page catalog shows construction, photos, specifications, performance characteristics. Royalton Co, Inc, Gasport, N. Y.

B62 **PROPORTIONING PUMPS** — Reciprocating units, variable capacity, simplex or duplex. 4-page bulletin gives specifications, construction, application. Bird-Archer Co, 4337 N American St, Philadelphia, Pa.

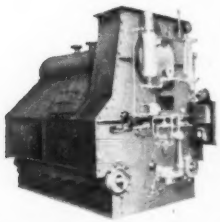
B64 **SUMP PUMPS**—Wet and dry pit types for clear liquids, sewage, etc. 8-page bulletin WQ-220 gives sectional views, impeller designs, dimensions, selection charts. Warren Steam Pump Co, Inc, Warren, Mass.

B65 **HYDRAULIC POWER UNITS**—Single, double and combination pump types. Catalog 400 gives working drawings, specifications, max pressures at a given hp, hp requirements at given pressures. Capacities from 4 to 48 gpm at 1000 psi. Rivett Lathe & Grinder, Inc, Brighton 35, Boston, Mass.

WICKES sales engineers all over the United States . . . to help you plan your new boiler installation



In twenty-three principal cities in the U. S. and in several industrial centers outside the country there is a Wickes sales engineer—who really knows boilers—ready to help you. This widespread sales organization, alone, helps greatly to increase the service you get from Wickes, and once you place an order for a Wickes boiler, Wickes engineers and production men get into production without delay. Wickes knows that when you want steam generating equipment, you want it. A Wickes installation is a complete installation. One contract covers all controls, all accessories, all engineering, all work from original survey to final brick-work and installation ready-to-go. ✓ ✓ ✓ Throughout the world, industries and institutions that depend on steam have learned to depend on Wickes for efficient, low cost steam power. Wickes can fill your requirements for steam generating equipment up to 250,000 lbs. per hour and 1000 psi.—all types of multiple drum boilers adaptable to any standard method of firing. Write today for complete information or consult a Wickes sales engineer.



WICKES THE WICKES BOILER COMPANY

DIVISION OF THE WICKES CORPORATION, SAGINAW, MICHIGAN

SALES OFFICES: Atlanta • Boston • Buffalo • Chicago • Cincinnati • Cleveland • Denver • Detroit • Greensboro, N.C. • Houston • Indianapolis • Los Angeles • Memphis • Milwaukee • New York City • Pittsburgh • Portland, Ore. • Saginaw • San Francisco • Springfield, Ill. • Tampa, Fla. • Tulsa • Washington, D.C.

141

RECOGNIZED QUALITY SINCE 1854

SOLVED! An Overhead PIPING PROBLEM

Babbitt —Adjustable— SPROCKET RIM with Chain Guide

• Range of 10 adjustable sizes takes care of all valve makes and types; fits valve wheel diameters from 2 to 30 inches.

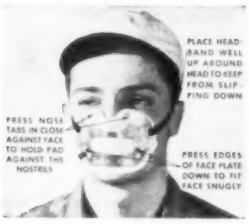
• Operation of valves in overhead piping is no longer a problem. Put valves where they should be, where they'll be most economical or efficient, even if necessary to place them out of reach. Easy, safe, positive control is provided by the BABBITT Adjustable Sprocket Rim with Chain Guide—right from the floor!

• The BABBITT Adjustable Rim fits all valves, with either rising or non-rising stems. It is installed quickly by clamping onto the hand wheel of the valve.

• *Write today for Catalog Bulletin P, surprisingly low prices, and name of nearest distributor.*

BABBITT STEAM SPECIALTY CO.
1 Babbitt Square, New Bedford, Mass.

MARTINDALE PROTECTIVE MASKS


PLACE HEADBAND WELL UP AROUND HEAD TO KEEP FROM SLIPPING DOWN
PRESS NOSE TABS IN CLOSE AGAINST FACE TO HOLD PAD AGAINST THE NOSTRILS
PRESS EDGES OF FACE PLATE DOWN TO FIT FACE SNUGLY

Weigh Less than ½ ounce.

Clean, cool, comfortable. Furnish excellent protection against non-toxic dusts except free silica. Replaceable cotton pads are inexpensive and sanitary.

Martindale Protective Masks	$.30 ea.
No. 1 Refills (Standard weight)	.02 ea.
No. 2 Refills (heavyweight)	.02½ ea.

Masks packed in individual envelopes. Refills packed in envelopes containing 25. No. 2 (heavyweight) Refills contain twice as much filtering cotton as No. 1.

DISCOUNTS

	Net
Less than $10.00 list	
$10.00 to $24.99 list	10%
$25.00 to $99.99 list	15%
$100.00 and over	20%
Minimum, charge account or C.O.D.	$2.00
Minimum, cash with order	$1.00

If payment accompanies order we will pay parcel post or express charges.

MARTINDALE ELECTRIC CO.
1367 Hird Ave. Cleveland 7, Ohio

APPOINTMENTS

R. C. Becherer

Link-Belt Co elects R C Becherer president and a member of the board of directors, succeeding George P Torrence who is retiring as president, but continuing a member of the board. Raymond S Wood becomes gen mgr of the ball and roller bearing plant in Indianapolis, succeeding C V Loughery who has retired.

Arthur D Little, Inc elects Allen Latham Jr vice-president. He will continue as technical director of the mechanical div. Dr Howard O McMahon becomes science director.

Chrysler Corp Airtemp div appoints John C Davidson asst mgr of application engineering.

Niagara Machine & Tool Works opens Philadelphia dist sales office at 50 E Wynnewood Rd, Wynnewood, Pa. Joseph J Ortalli is dist mgr.

National Electric Products Corp names Joseph J Gretter Jr asst service mgr; Charles F Meyer becomes asst eastern regional mgr and New York dist mgr.

Barber-Colman Co will purchase principal assets of Wheelco Instruments Co. They plan to continue current operations in Chicago until manufacturing facilities can be gradually transferred to Rockford, Ill. They contemplate no changes in Wheelco's national sales and service organization.

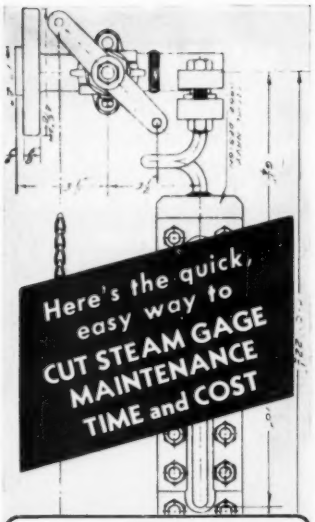
Blaw-Knox Co appoints Arthur A Levison vice-president and gen sales mgr of its Blaw-Knox div. H Russell Loxterman will assist him. Otto G Schwenk becomes vice-president in charge of industrial products.

General Motors Corp appoints Paul R Turner director of sales of the electromotive div.

General Cable Corp appoints L P Shull dist mgr of the Lake dist, with headquarters at Detroit, replacing W A Craveson who is retiring.

Ansul Chemical Co fire extinguisher div district offices have new addresses: 17184 Wyoming, Detroit 21, Mich; and 2755 N Third St, Milwaukee 12, Wis.

General Electric Co meter and instrument dept appoints Donald E Craig mgr of the Somersworth, N.H. plant, John C Garrett acting mgr of marketing, Leo P Hannaway asst to the mgr of marketing, and Jeremiah E McQuillan mgr of marketing services.



Install Labor-Saving JERGUSON STEAM GAGE UNITS

. . . with gage and valves furnished as integral unit . . . without gage connection stuffing boxes or end stems.

JERGUSON Steam Gage Units, with gage and valves fabricated as a complete working unit will help you eliminate a lot of your maintenance time and troubles.

Especially designed to cut maintenance time, these complete units have no gage connection stuffing boxes to take care of and no end stems to cut or wire draw.

Gages and valves are an integral unit and have special expansion coils to take care of expansion and contraction. Transparent gage may be rotated to any desired angle; chambers and covers are forged steel; glasses are mica protected against erosion. Available in various models for required visible glass and W.S.P.

Cut your maintenance costs now. Write today for copy of drawing GD-515 and Steam Gage Data Unit.

JERGUSON

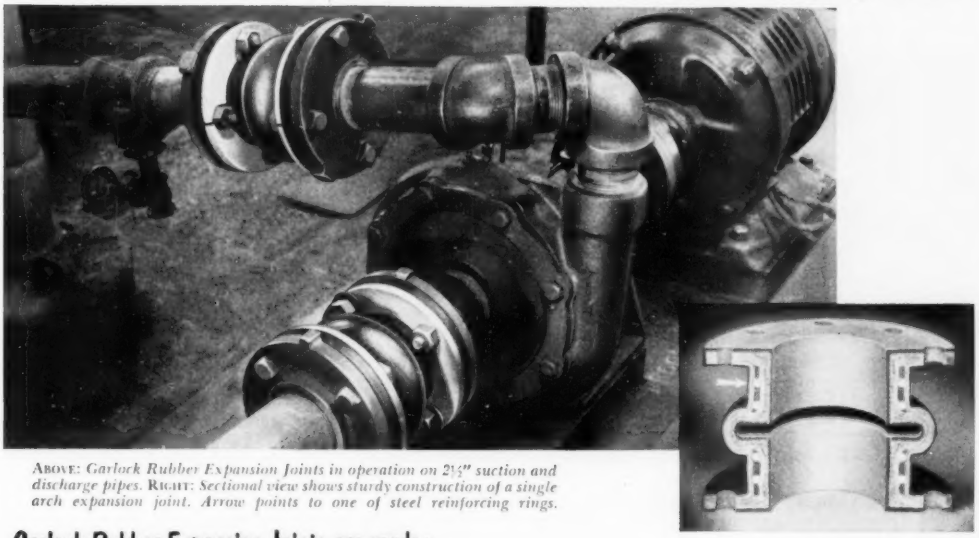
Gages and Valves for the Observation of Liquids and Levels

JERGUSON GAGE & VALVE COMPANY
100 Fellsway, Somerville 45, Mass.
Representatives in Major Cities
Phone Listed Under **JERGUSON**
Jerguson Tress Gage & Valve Co. Ltd., London, Eng.

GARLOCK EXPANSION JOINTS

STOP VIBRATION–

relieve stresses and strains in piping and equipment



ABOVE: *Garlock Rubber Expansion Joints in operation on 2½" suction and discharge pipes.* RIGHT: *Sectional view shows sturdy construction of a single arch expansion joint. Arrow points to one of steel reinforcing rings.*

Garlock Rubber Expansion Joints are made:

- With single arch for normal expansion, contraction and vibration.
- With multiple arch for excessive pipe expansion.
- With filled arch for lines carrying sediment.
- Tapered for connecting pipes of different diameters.
- "U" type for vacuum to reduce vibration and noise on pipe lines conveying coal-laden air to pulverized coal burners and other types of light construction piping.
- With control units for excessive elongation of unanchored pipes.
- With neoprene lining for lines carrying water or air with some oil present.
- With neoprene lining and neoprene cover for lines carrying slight amount of oil and where exterior of joint is subject to oil drip or oil vapor.
- With neoprene throughout for lines carrying petroleum derivatives.
- In all pipe sizes from ¾" to 72".

Specify No. 204 for *Pressure*; No. 205 for *Vacuum*; and No. 206 for *Pressure* and *Vacuum*.

THE GARLOCK PACKING COMPANY
PALMYRA, NEW YORK
In Canada: The Garlock Packing Company of Canada Ltd., Toronto, Ont.

8 Big Advantages:

1. Made of high-grade rubber, they do not crack or fracture under repeated flexing.
2. They do not take a permanent set.
3. For pressures up to 125 p.s.i. (depending upon size of joint); and for vacuum of 30 in. of mercury.
4. Suitable for operating temperatures up to 180° F.
5. They do not corrode or erode.
6. They are light in weight and can be installed in a limited space.
7. They require no gaskets between the flanges of the joint and the flanges of the pipe.
8. They do not induce electrolysis.

GARLOCK

PACKINGS, GASKETS, OIL SEALS, MECHANICAL SEALS, RUBBER EXPANSION JOINTS

SQUIRES STEAM & AIR TRAPS

DEPENDABLE DRAINAGE

The Genuine SQUIRES upright bucket trap is the forerunner of all present day steam traps of similar design. Combining ruggedness with simplicity of design it insures long and uninterrupted service.

Equipped with *Automatic Air Release,* SQUIRES steam traps will rapidly expel air with condensate, without loss of steam, shortening time of warm-up period, giving faster heat and cutting down length of heating period necessary on many types of installations. Prevent air binding.

Only one internal part of the SQUIRES trap is subject to friction movement. The patented cone bucket hinge, accounting for the low maintenance required to keep SQUIRES in first class condition, demanded in these times by the most exacting operators.

Positive water seal in SQUIRES traps absolutely prevents steam loss as discharge tube is always completely full of water.

SQUIRES—MOUAT Heating Specialties, radiator traps, air vents, float traps, bucket traps etc. are the latest addition to the SQUIRES family of steam equipment. *Write for further details.*

THE C. E. SQUIRES COMPANY

Over 50 Years of Dependability

18502 SYRACUSE AVENUE • CLEVELAND 10, OHIO

More APPOINTMENTS

Begins on page 236

Henry J Chanon becomes mgr of original installation sales for the lamp div; James C Forbes replaces him as mgr of the lighting institute at Nela Park.

Four section mgrs are appointed for the new silicone products dept: Robert O Sauer, mgr-engineering; James R Donnalley, mgr-manufacturing; Mark K Howlett, mgr-marketing; Paul D Williams, mgr-finance.

American Brake Shoe Co elects Fred P Biggs vice-president of the company. W Frank Kelly becomes asst vice-president, and John E Holtman gen supt of foundries of the American Manganese Steel Div.

Midwest Piping and Supply Co Inc moves eastern div offices to 50 Church St, New York 7, N.Y.

Worthington Pump & Machinery Corp changes name to Worthington Corp to prevent erroneous conclusions that pump manufacture is its only endeavor. C K Hood is appointed vice-president in charge of the public works, steam power, deaerating, water treating and steam turbine divs. W J Van Vleck becomes mgr of the New York dist sales office; C W Kramer is mgr of the Atlanta office; I W Leggett mgr of the Charlotte branch office.

A L Jones becomes mgr of the water treating div; Donald W Bedell is industrial relations asst to L C Ricketts, v-p in charge of manufacturing.

C H Wheeler Mfg Co appoints Robert J Mac Meekin chief engineer of the pump div. H C Fullam becomes chief industrial engineer in charge of methods and tool engineering, tool manufacturing and maintenance of plant equipment at Philadelphia.

Iron Fireman Mfg Co appoints E C Webb vice-president in charge of production and engineering.

Independent Pneumatic Tool Co appoints Arthur H Nelson mgr of electric tool sales in Chicago.

Oakite Products Inc moves its general offices to 19 Rector St, New York 6, N.Y.

Owens-Corning Fiberglas Corp appoints Jacob W Coleman Jr mgr of apparatus insulation sales, textile products div. Fowler Blauvelt becomes mgr of wire and cable sales.

Permutit Co appoints Martin E Gilwood director of research in charge of research, analytical and pilot-plant laboratories. Albert P Super becomes research engineer in the special applications dept.

Pacific Public Services Co elects J K Horton president, succeeding Ernest G Lawson who has retired.

Quaker Rubber Corp elects H M Sossaman vice-president in charge of commercial development; J R Lewis succeeds him as gen sales mgr. A stock-carrying branch warehouse and sales office is established at 4006 Papin St, St. Louis, Mo. J H Joyner is dist sales mgr.

Rust-Oleum Corp appoints the following new distributors: Adkins Co, Baltimore

To master high temperatures and pressure these leading companies use

M. W. KELLOGG

power piping!

American Gas & Electric Service Corp.
Boston Edison Co.
Central Hudson Gas & Electric Co.
Chaudronneries A. F. Smulders (Belgium)
Compania Argentina De Electricidad (Argentina)
Compania De Fuerza Del Suroeste De Mexico S.A. (Mexico)
Consolidated Edison Co. of N. Y.
Detroit Edison Co.
Dow Chemical Co.
Elektricitetsselskabet Isefjordvaerket (Denmark)
Ford Motor Co. of Canada Ltd. (Canada)
General Electric Co.
Hartford Electric Light Co.
Houilleres Du Bassin De Lorraine (France)
Houilleres Du Bassin Du Nord Et Du Pas-De-Calais (France)
Hydro-Electric Power Commission of Ontario (Canada)
Indiana & Michigan Electric Co.
Interbrabant (Belgium)
Long Island Lighting Co.
Metropolitan Edison Co.
Mexican Light & Power Co. (Mexico)
Monongahela Power Co.
New York State Electric & Gas Corp.
Niagara Mohawk Power Corp.
Palestine Electric Corp., Ltd. (Israel)
Philadelphia Electric Co.
Public Service Co. of Northern Illinois
Public Service Electric & Gas Co. of N. J.
Societe Anonyme John Cockerill (Belgium)
Societa Edison (Italy)
Societe Financiere De Transports Et D'Entreprises Industrielles (Sofina) (Belgium)
Societa Meridionale Di Elettricita (Italy)
Sociedad De Electricidad De Rosario (Argentina)
Union D'Electricite (France)
United Illuminating Co.
Westinghouse Electric Corp.
West Penn Power Co.
Wisconsin Public Service Corp.

6000 Pictures Looking for "Eyebrows" in critical power piping . . . *because—*

Through the photomicroscope, metallurgists carry on a never-ending search for evidence of graphitization, the phenomenon which prior to 1943 was considered of only academic interest.

They are hunting particularly for what they call the "eyebrow" or chain type of graphite. It is these malformations that cause planes of weakness in carbon steel and carbon moly hi-temp-hi-pressure power piping . . . weaknesses that can result in serious failures.

Since graphitization occurs only after piping has been in high temperature service for sometime, means of precluding its formation can usually be determined only from studies of specimens in which the phenomenon has occurred.

Although the "whys" are unknown, metallurgists have already come up with methods of inhibiting the formation of graphite in carbon steel or carbon moly piping. Annealing welds at about 1300 F appears to help. Addition of chromium to carbon moly analysis piping seems to preclude graphite formation entirely; at least no graphitization has yet been detected in this type of piping which Kellogg recommended for such severe service nearly a decade ago.

Still Kellogg metallurgists continue to research the problem, endeavoring to pinpoint the causes of graphitization and to improve fabricating techniques and materials. More than 6,000 test pieces —cut out of actual service piping —have been polished, etched, photographed and evaluated in the last nine years. Such fundamental knowledge is a valuable *plus* obtained by any utility company when it specifies "Main steam and reheat piping by Kellogg".

OTHER FABRICATED PRODUCTS including:

Pressure Vessels . . . Vacuum Vessels . . . Fractionating Columns . . . Drums and Shells . . . Heat Exchangers . . . Process Piping . . . Bends and Headers . . . Forged and Welded Fittings . . . Radial Brick Chimneys

for 51 years an integral part of industrial progress!

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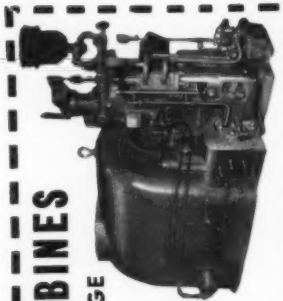
New York, Jersey City, Buffalo, Los Angeles, Tulsa, Houston, Toronto, London and Paris.



STEAM TURBINES

TYPE UV MULTISTAGE

• Available with from two to ten pressure stages. Horsepower range from 100 to 4000, steam pressures up to 600# ga., 750° F., condensing or non-condensing. Optional governor equipment and accessories adopt UV Turbines to any mechanical drive within their capacity range.

Contact your Murray representative or write for Bulletin T-122.

MURRAY IRON WORKS COMPANY, BURLINGTON, IOWA

MURRAY

Builders of Steam Power Equipment for over 75 years

More APPOINTMENTS

Begins on page 236

Ave, Berlin, Md.; Mill and Contractors Supply Co, 121-3 Water St, Wilmington, N.C.; Warren Hardware Co, 183 W Market St, Warren, Ohio; American Radiator and Standard Supply Corp, 130 N 3rd St, Zanesville, Ohio; Couch and Heyle, 1016 S Adams St, Peoria, Ill.; Republic Supply Co of California, 2600 S Eastland Ave, Los Angeles, Calif.; Buhl Sons, Foot of Adair St, Detroit, Mich.

Westinghouse Electric Corp transformer div appoints R N McCollom mgr of the application engineering dept. This dept is divided into two major groups—power equipment and distribution equipment. J L Cross is mgr of power equipment, J C Rissinger mgr of the power transformer section, R C Brannan mgr of the transformer equipment section. R D Rung is mgr of distribution equipment, R M Ray mgr of distribution transformer section, R O Hurst mgr of instrument transformer section, R M Atwood mgr of renewal parts section.

The technical publicity dept moves to 401 Liberty Ave, P O Box 2278, Pittsburgh.

E F Drew & Co Inc appoints these power chemical div district engineers: B S Farley, Baltimore; James Quigley, Newark; A L Stahl, Chicago; Arthur Swenson, Syracuse; J D Gibson, Knoxville; Ralph D Bartow, Tulsa; C R Oller, Oakland Co, Calif.; A J Powers, San Francisco. A W Gorline is St Louis service mgr.

Roots-Connersville Blower Corp is absorbed into the corporate structure of its parent, Dresser Industries, Inc, and will operate under the name Roots-Connersville Blower, div of Dresser Industries, Inc. No changes in organization or plant facilities are contemplated.

Dravo Corp appoints James L Everett administrative asst to the general mgr of the engineering works div.

Caterpillar Tractor Co appoints W C Birdzell to take charge of purchasing operations at a new plant near York, Pa. Ridley Orton becomes purchasing agent at Peoria; W G Schuller is asst gen purchasing agent for the company; C W Russell becomes purchasing agent at Joliet, Ill. Wm G Thannert is factory mgr of Trackson Co, a wholly-owned subsidiary.

Consolidated Products Co, Inc appoints Wm A Schnell to its sales staff.

Allis-Chalmers Mfg Co names J D Greenswald mgr of its new apparatus dept. Charles R Gibbs becomes asst supervisor of mechanical service and erection. D A Griffith and D K Steidinger are now asst mgrs of the Washington district office.

Atlas Chain & Mfg Co appoints Frank Ingham Cleveland mgr.

Arerods Corp elects W E Brainard president and director, replacing J H Humberstone who becomes chairman of the board. C A Wagner is controller.

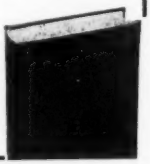
H E Bovay Jr organization becomes a partnership consisting of H E Bovay Jr, Bennett W Burns, Charles A Lawler, J

AIR POLLUTION

Proceedings of the United States Technical Conference on Air Pollution

Just Published!

1. **A systematic presentation of useful information on air pollution:** its effect on human, plant, and animal life; the measures being taken to control it; and the legal and administrative problems which are being overcome connected with pollution prevention and control. Contains detailed analyses of different contaminants; describes latest equipment used; etc. **Sponsored by the Interdept. Comm. on Air Pollution. Chairman: Louis C. McCabe, Chief, Office of Air and Stream Pollution. 847 pages, $12.50**



ENERGY SOURCES

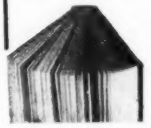
The Wealth of the World

Just Published!

2. **A thorough census of our energy sources—past, present, and future.** Reviews the size of fuel supplies, technology of production efficiency, conversion, and progress in conservation. Shows how man has used energy in the past and what use he may expect in the future. Everything from fossil fuels and hydroelectric power generation to nuclear and solar energy is discussed. **By Eugene Ayres, Gulf Research & Development Co., and Charles A. Scarlott, Editor, Westinghouse Engineer. 344 pp., 114 illus., $5.00**

FUELS AND COMBUSTION HANDBOOK

3. **Presents comprehensive data covering the full range of commercial fuels and their combustion.** Gives practical aid in the selection and use of fuels and all types of fuel combustion equipment. Applies rapid computation technique of alignment charts and uses comparative tables to show advantages, disadvantages, average performance data, etc., of optional equipment and methods. **Edited by Allen J. Johnson, Cons. Eng., George H. Auth, Villanova Coll. 915 pp., 403 illus., $12.50.** (Available on easy terms.)



HOW TO SUPERVISE PEOPLE

Just Published!—Third Edition

4. **On-the-job facts for supervisors—in shop, field, or office.** Solves problems in hiring, discipline, preventing accidents, promoting teamwork, training workers, delegating authority, labor relations, etc. Presents examples of typical problems and specific solutions now in use. Third edition includes discussion of the Taft-Hartley law as it affects the supervisor, outlines a program for employee participation in management, and provides other new material. **By Alfred M. Cooper. Third Edition, 254 pages, $3.75**

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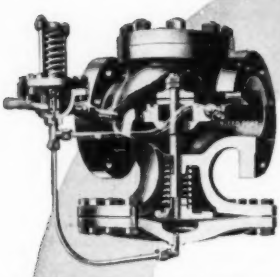
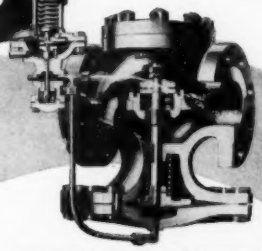
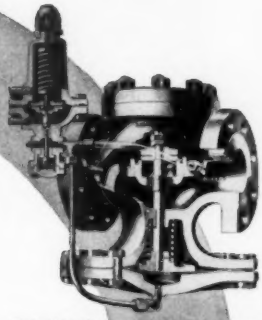
- **Single-seat Packless Construction**
- **Large Balanced Metal Diaphragm**
- **Sensitive Pilots**
- **SECO Metal Seats and Discs**
- **Springs out of path of steam**
- **No dismantling for inspection**



BACK PRESSURE CONTROL—Wide selection of sensitive pilots to meet exacting requirements. Initial pressure closing, guaranteed to shut tight. Packless construction, metal diaphragms.

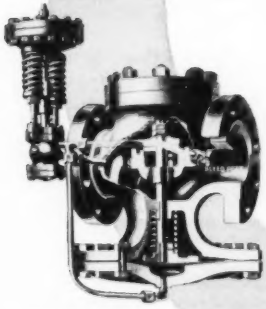


PRESSURE REDUCING—Self-operated, dead-end regulators powered by large, frictionless, metal diaphragms. Sizes ¼ in. to 12 in. Pressures to 600 psi 750 F.

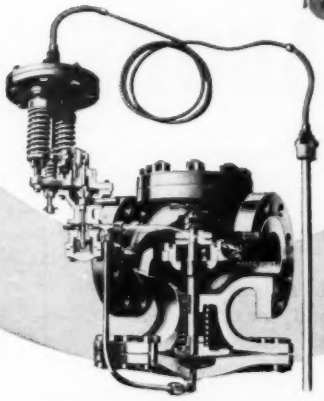


DIFFERENTIAL PRESSURE—Accurate control of delivery pressure at a constant, adjustable differential from 3 to 150 psi above another source of fluid pressure.

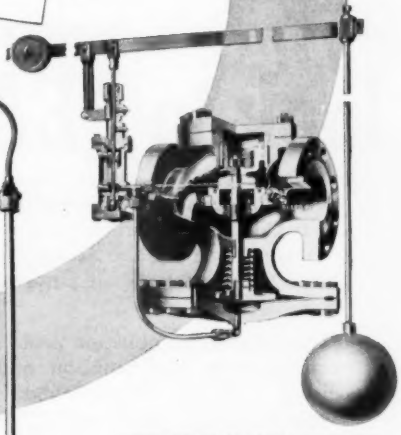
WRITE FOR BULLETIN 350
for complete details on Spence's line of automatic regulating valves



PUMP GOVERNOR—Constant or excess pressure control for steam pumps. Steam pressures to 600 psi 750 F, pump discharge pressures to 2000 psi.



TEMPERATURE REGULATING—Combined temperature and pressure control. No separate reducing valve required. Shuts tight, will not wiredraw or be damaged by overheating. Sizes to 12 in.



LEVER OPERATED—Pilot lever for connection by cable or mechanical linkage to floats or other devices. Slight actuator motion opens and closes main valve.

SE-113

SPENCE ENGINEERING COMPANY, INC.
WALDEN, NEW YORK

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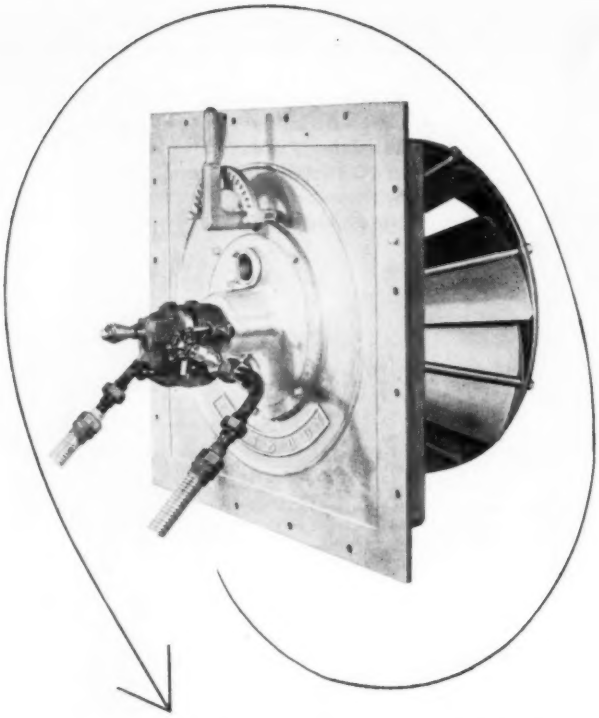

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The same principles of design that have made Peabody Oil and Gas Burners the standard of excellence the world over are also available in Peabody Combined Burners for gas, oil, pulverized coal, and other types of fuels.

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Manufacturers of all types of combustion equipment, direct-fired air heaters, gas scrubbers, coolers, and absorbers.

OFFICES IN PRINCIPAL CITIES
PEABODY LIMITED • LONDON, S.W.1, ENGLAND

More APPOINTMENTS

Begins on page 236

Wayne Holland and Richard B Robertson. Firm name and location remains the same.

Allegheny Ludlum Steel Corp changes the name of its sintered carbide production and sales units from Carbide Alloys div to Carmet div.

Rockwell Mfg Co appoints M D Gilbert Kansas City Dist sales mgr, and Roy R Bush Tulsa dist sales mgr.

Baldwin-Lima-Hamilton Corp appoints R B Crean to direct its new Southwark and special product div; Walter A Rentschler is now in charge of the Eddystone div; J F Connaughton is gen mgr of the Hamilton plant; Alex Smith is mgr of the new export sales dept, assisted by C A Campbell.

Baldwin-Hill Co appoints P A Bell dist mgr of industrial sales in the New England area.

Bacharach Industrial Instrument Co purchases all inventories and production facilities of Curtiss & Smith Mfg Co of Pottstown, Pa.

United Engineers and Constructors Inc elect Franklin L Johnston and Henry B Bryans vice-presidents and members of the board of directors. Thomas A Currie Jr is new vice-president and construction mgr.

Vapor Recovery Systems Co appoints two new sales agencies: Arduser & Co, P O Box 4267, Tulsa 9, Okla., and Paul B Mueller Co, 1033 Metropolitan Life Bldg, Minneapolis, Minn.

Cox & Co, Inc elects Herbert M Brusman vice-president in charge of sales.

Toledo Pipe Tools appoints Harold W Sabin sales representative in the Pacific northwest, with headquarters in Seattle, Wash. James L Emch is new sales representative in the north central states, with headquarters in Kansas City.

Sam Tour & Co, Inc appoints Henry N Shoiket head of the mechanical engineering dept.

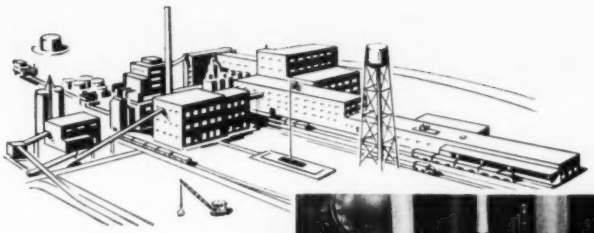
Allen B DuMont Laboratories, Inc promotes five members of the instrument div. Dr P S Christaldi is asst div mgr; G Robert Mezger is engineering mgr; Emil G Nichols is technical sales mgr; Melvin B Kline and Wm G Fockler are asst engineering mgrs.

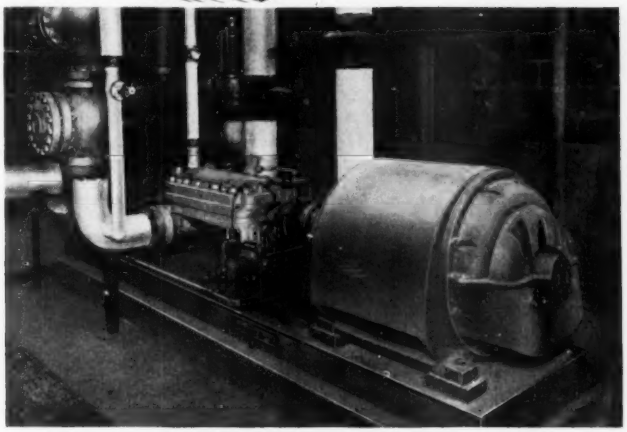
Sterling Electric Motors, Inc opens new sales offices at 12 San Jose Ave, New Orleans 21, La., in charge of J D Trice; 1726 Champa St, Denver, Colo., in charge of James R Hughes.

A V Smith Engineering Co moves to Coulter Bldg, 121 Coulter Ave, Ardmore, Pa.

General Box Co elects N W Embry chairman of the board, succeeding E E Ames, who continues as a director. J A Cragwall is elected president, and Roy E Welch is promoted to mgr of the Kansas City div.

Graybar Electric Co elects W E Henges president, and R B Sayre asst vice-presi-





RIEGEL-CAROLINA'S NEW PULP MILL

uses I-R Boiler Feed Pumps

Two 6-Stage HMTA Pumps Help Generate Plant Power

Located on the Cape Fear River at Acme, N. C., Riegel-Carolina Corporation's new mill will produce 200 tons of bleached sulphate pulp daily in full-scale operation. Nearby timberlands in the Waccamaw forest will provide raw material to the 45-acre mill site.

7500 kw of electricity and process steam for the mill is generated on the premises in wood refuse and oil fired boilers. An Ingersoll-Rand, 6-stage Class HMTA centrifugal pump supplies 550 gpm to the boilers at 805 psig. A duplicate stand-by unit is arranged for both turbine and motor drive. Incorporating the Unit-Type rotor assembly designed for higher efficiency and greater dependability, these pumps are, like the mill they serve, completely modern in every detail.

For boiler feed pumps, and for centrifugal pumps for all types of service consult Ingersoll-Rand. Ninety years of experience and the complete line available will result in the best solution to your particular application.

Seventy other I-R Pumps handle these liquids at the Acme Mill:

- Alkaline cooking liquor
- Black liquor
- Heater condensate
- Heavy stock
- Light stock
- Bleach chemicals
- White water
- General service water

Ingersoll-Rand

Cameron Pump Division 741-10
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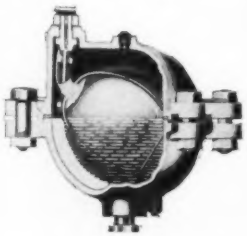
PUMPS • COMPRESSORS • CONDENSERS • DIESEL ENGINES • VACUUM EQUIPMENT • AIR AND ELECTRIC TOOLS

GET RID OF AIR ACCUMULATIONS IN PIPE LINES...



a BIG Trouble Saver that Costs You LITTLE!

When air lodges at high spots in pipe lines, it reduces the effective area of the pipe, creates a friction head, lowers pumping capacity, and may result in serious water hammer!

Simplex Air Release Valves bring you a sure, efficient cure for these difficulties . . . venting air *automatically before it can cause damage.*

The Simplex Air Valve is easily installed . . . positive in action . . . ample in capacity. Standard valves for pressures up to 250 p.s.i. . . . special valves for pressures up to 800 p.s.i. Thousands have been in successful use for over 30 years.

IT'S SIMPLEX IT'S ACCURATE

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BOILER TUBES BY AIR?

We'll ship tubes via air freight if you need them urgently . . . anywhere . . . anytime . . . and in any quantity.

If they're bent or formed tubes, we have boiler manufacturers' drawings in our files; all we need is your tube code numbers and a few extra hours to make and test the bends. One of the largest warehouse stocks of boiler and pressure tubes in the country is at your service. Straight tubes can be supplied from warehouse stocks.

Other Murray products include stainless pipe and tubing, carbon steel pipe, seamless mechanical tubing, pipe fittings, boiler tools and accessories. Write for current Stock Bulletin.

More APPOINTMENTS

Begins on page 236

dent. New Jacksonville dist mgr is D L Harper, and new mgr of the Omaha branch is F M Sholders.

Royalton Co, Inc appoints these sales representatives for pipe line expansion joints: Energy Control Co, New York, Philadelphia, Baltimore, Wilmington, Harrisburg, Newark, New Haven, Albany; Toole & Cunningham, Houston, Dallas, Denver; John Zimmermann, Louisville, Ky; Cooley and Schlee, Detroit, Mich; Wm G Jewett, Cleveland and Columbus, Ohio; Bristol Metal Products Co, Pittsburgh, Pa.

Hewitt-Robins Inc has purchased the outstanding stock of Korb-Pettit Wire Fabrics and Iron Works Inc. H M Ross is now in charge of Korb-Pettit, John Belli is mgr of sales operations, and F J Volkommer is production supt. R L Carr is asst to the mgr, and H E Kleintop chief engineer. Positions of other Korb-Pettit employees remain unchanged.

John Hewson Co opens new office in the National Bank Bldg, Ambler, Pa., P O Box 163. Frederic T Hults is appointed dist mgr.

Hays Corp appoints Phil Sprague Jr executive vice-president, and Paul B LeBoeuf advertising mgr.

Hammel-Dahl Co appoints Cowles & Co, Dallas, Texas, sales and service representatives.

Pittsburgh Corning Corp appoints C P Barrett eastern mgr of industrial insulation sales, with offices in New York City. Harry W Bennett is new dist mgr of the Chicago office.

Johns-Manville Corp appoints Miles W Burleson asst mgr of the insulation dept.

National Supply Co appoints Charles K Olson asst gen mgr of the engine div; P W Place is new staff asst to the gen mgr. J D Myers becomes general supt.

New Orleans Public Service Inc appoints J Mason Guillory director of advertising. John F Morton becomes mgr of the industrial div; James L Campbell mgr of the commercial div, and Charles J Sinnott mgr of the residential div.

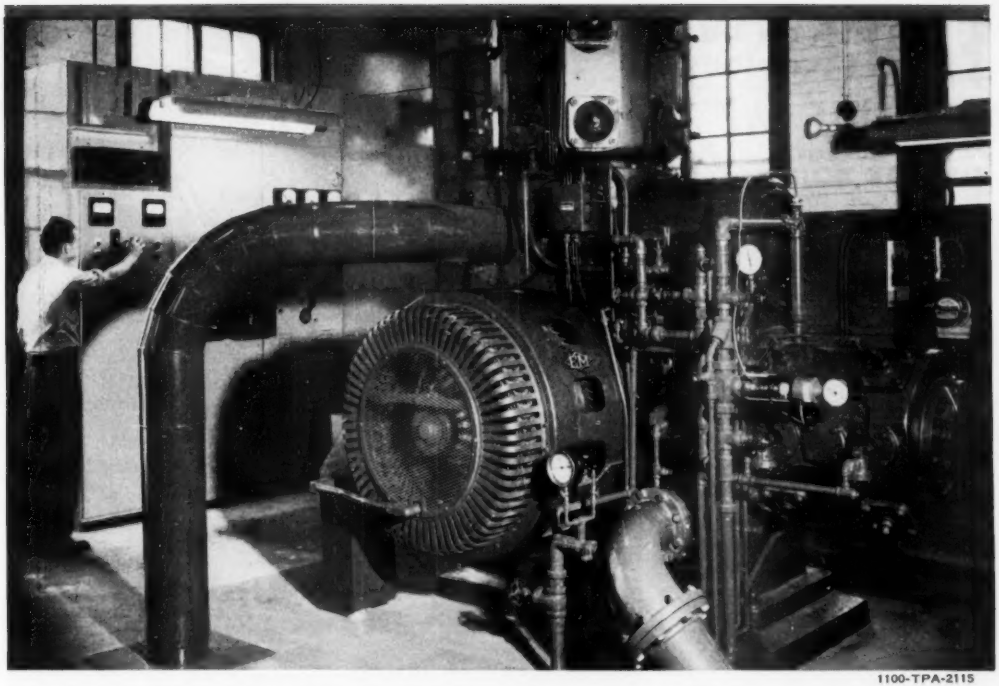
Libby-Owens-Ford Glass Co appoints J M Johns gen mgr of its new fiber-glass div, and names Herbert A Fox technical mgr of that div. New fiber-glass div district sales office at 120 S LaSalle St, Chicago, is under direction of Mark Joseph Wells.

O C Keckley Co appoints Kenneth E Lankton in charge of the industrial distributor dept.

Ampco Metal Inc appoints Kirk-Wicklund & Co, Kansas City, Mo. a distributor for northern and eastern counties of Kansas.

Automatic Steel Products, Inc appoints John E Cinkosky eastern zone mgr for the Mercury clutch div.

Alloy Steel Products Co appoints Wm P Simmons sales representative for the western territory, with headquarters in San Francisco.



1100-TPA-2115

How to Make Compressors Take up Less Space

Want to save some valuable floor space?

Here's how it is done on the air compressor drive installation above:

The compressor is driven by a 200 hp, 514 rpm E-M Synchronous Motor, overhung mounted. Stator and rotor are mounted directly on compressor frame and crankshaft. Motor bearings as well as losses from belt drives and couplings are eliminated. The drive motor thus becomes a compact, integral part of the entire compressor unit.

You'll save space on any compressor with a direct-connected E-M Synchronous Motor. E-M engineers possess a unique background of experience in tailoring Synchronous Motor characteristics to drive requirements of every type of compressor. This skill, plus E-M's knack for condensing drive units into least possible space, should be considered when you plan your next compressor installation.

Also, you'll find that E-M Synchronous Motors can improve plant power factor and reduce power costs. For example, an E-M Motor rated at 0.8 leading power factor will furnish sufficient leading reactive KVA to correct a low power factor condition which may be caused by demands of other plant equipment.

Ask your nearest E-M sales engineer to demonstrate how these E-M benefits can be applied to your specific requirements. And write the factory for E-M Synchronizer No. 32, the air compressor number.

...the man at the controls

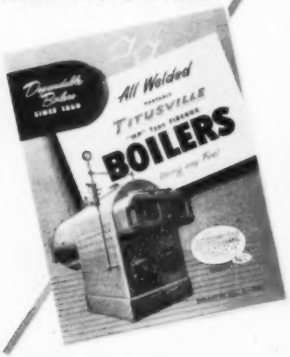
starts, stops and protects the motor with E-M special feature Controls... magnetic, for automatic operation... full-voltage, for economical starting... dead-front panels for maximum safety ... overload and undervoltage protection ... and the exclusive E-M Polarized Field Frequency Relay system, simplest and most ingenious method ever developed for perfect synchronizing.

ELECTRIC MACHINERY MFG. COMPANY

MINNEAPOLIS 13, MINNESOTA

POWER THAT THINKS...E-M SYNCHRONOUS MOTORS AND "CONSCIOUS" CONTROLS

FACTS ON THE FAMOUS TITUSVILLE "WP" ALL-WELDED FIREBOX BOILERS



WRITE for your copy...

ASK FOR BULLETIN B-3030

THE TITUSVILLE IRON WORKS CO.
TITUSVILLE, PA. division of
STRUTHERS WELLS CORPORATION

Bent or Straight

We have them in standard or extra gauges in all sizes. Accurately fabricated to any specification.

BOILER TUBE CO. OF AMERICA

McKEES ROCKS, PA. (Pittsburgh District)

PITTSBURGH CHICAGO — FRED S. RENAULD & CO LOS ANGELES

Refinite serves the World

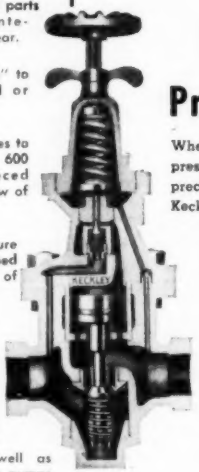
WITH WATER CONDITIONING EQUIPMENT & SERVICE

Refinite OMAHA, NEB.

WATER REFINING EQUIPMENT

WRITE FOR FREE BULLETINS ON HOW REFINITE CAN SERVE YOU. ADDRESS: DEPARTMENT P-A

- "Unit Pilot Valve" easily removable — and renewable.
- Stainless Steel parts for lower maintenance, longer wear.
- Sizes from ½" to 6" — Screwed or flanged.
- Initial pressures to 300 lbs. steam, 600 lbs. air. Reduced pressures to a low of 1 lb.
- Varied pressure control obtained without change of springs.
- Available in various combinations for pressure control, temperature control, single unit pressure and temperature regulation as well as constant pressure pumps governors.
- Completely interchangeable parts for comparable sizes.



Control reduced pressures *more accurately!*

KECKLEY Pressure Regulators

Where you have to maintain ACCURATE reduced pressures for air or steam, your best bet is a precision pressure regulating valve from Keckley. These valves feature a highly sensitive diaphragm and spring design that gives dependable automatic compensation for fluctuating initial pressures, giving constant reduced pressures that you can depend on. Standard stainless steel unit pilot valve, main valve and seat can be removed easily for inspection. Here is a valve that is rugged, dependable and unbelievably economical to maintain.

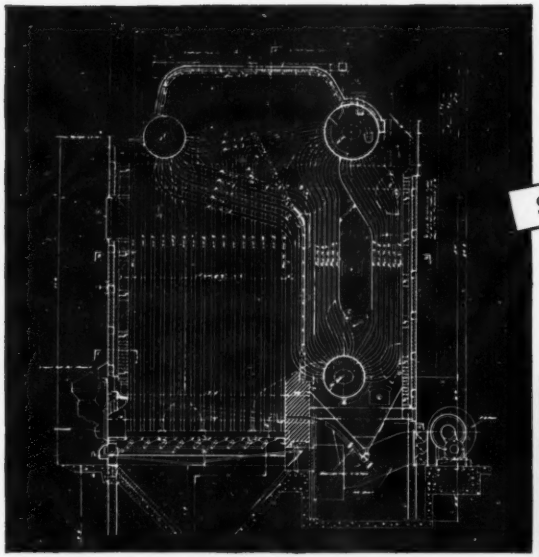
Standardize on Keckley for the best in pressure regulators.

Send for your copy of this catalog—51-A

O. C. KECKLEY COMPANY

400 W. Madison St. • Chicago 6, Ill.

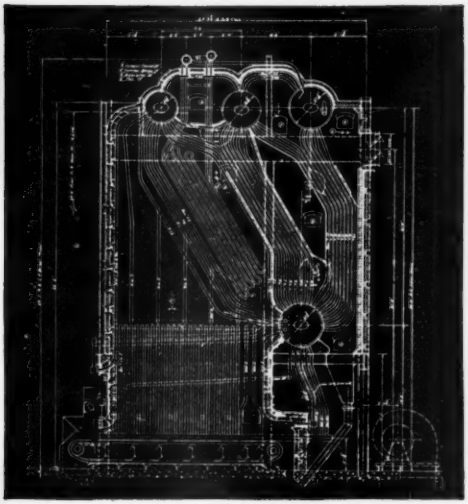
Quick Steaming at all Ratings!



Carry high overloads with high efficiency

SPECIFY Vogt

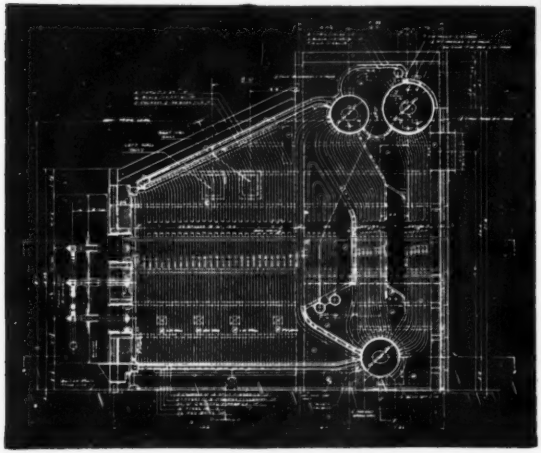
STEAM GENERATING UNITS



CLASS VL Two 27,500 pounds per hour units, installed at Brown-Forman Distillers Corporation, Louisville, Ky. Features large furnace volume in limited space, with high ratio of radiant heating surface.

CLASS LE Mt. Carmel Public Utility, Mt. Carmel, Illinois, is served by this 60,000 pounds per hour unit. Generous steam liberating surfaces and steam space permit wide fluctuations in load.

CLASS VR 70,000 pounds per hour steam generator at Humble Oil and Refining Company, Johnsue, Texas. An efficient, high-duty unit with water cooled furnace, using refinery gas fuel.



Vogt builds a complete line of bent tube steam generators, designed to burn solid, liquid, or gaseous fuels to meet specific operating conditions. Superheaters, air preheaters, economizers, water walls, and soot blowers can be readily incorporated. Bulletins with general information and showing typical installations are available upon request.

HENRY VOGT MACHINE CO.

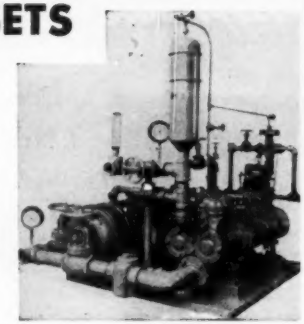
LOUISVILLE 10, KENTUCKY

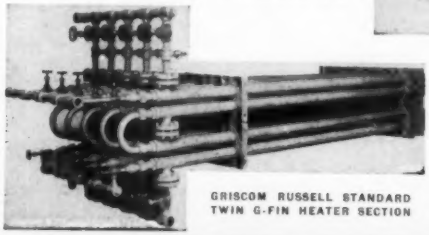
BRANCH OFFICES:
NEW YORK, PHILADELPHIA, CLEVELAND
CHICAGO, ST. LOUIS, DALLAS

LOCKETT FUEL OIL PUMPING and HEATING SETS

Custom Built

For almost a half century, Lockett has been supplying, to fit individual needs, efficient, standard and custom-built, Fuel Oil Pumping and Heating Sets, for mechanical and steam atomizing oil burners. Combinations of various types of pumps are available. Each pump is suitable for the full rated capacity of the unit; and one heater section is a spare. Lockett supplies everything, complete. Inquiries are invited. *Ask for Bulletin AML-40-2.*





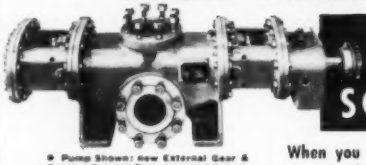
GRISCOM RUSSELL STANDARD TWIN G-FIN HEATER SECTION

The efficient, compact unit illustrated above, consists of one Worthington Duplex Steam Pump and one Electric-driven Pump.

Heaters for Lockett Pumping and Heating Sets consist of the proper number of G-Fin Sections mounted in parallel, or series, with one unit as a spare. *Ask for Bulletin AML-40-4.*

A. M. LOCKETT & COMPANY, LTD.
Contracting Mechanical Engineers
NEW ORLEANS - HOUSTON - DALLAS - GALVESTON

DOUBLE THE VALUE OF YOUR PUMP DOLLARS!



Specify *Sier-Bath* SCREW PUMPS

• Pump Shown: new External Gear & Bearing Bracket Type for non-lubricating fluids, semi-fluids. Capacities 1-700 GPM; Discharge 1000 PSI for viscous liquids, 500 PSI for water.

When you choose a Sier-Bath Screw Pump your total investment is about the same—but you get a pump worth *twice as much:*

Investment "A"	TYPICAL CHOICE	*Investment "B"*
Cam, Lobe, Vane or Gear Pump..... $ 770.00	Sier-Bath Screw Pump..... $1570.00	
Low Speed Motor (or high speed motor plus reduction gearing)..... 2580.00	High Speed Motor..... 1860.00	
TOTAL..... $3350.00	TOTAL..... $3430.00	

Sier-Bath Screw Pumps are more dependable, need less maintenance, and last longer than the types listed in "A". Because their *axial flow* allows low liquid velocities with higher RPM, they use less expensive (and easier to get) high speed motors. As these motors provide service equal to that of low speed motors—and as Sier-Bath Screw Pumps provide *superior* service—"B" is the right choice.

For further information, see your local Sier-Bath Representative, or write to

Sier-Bath GEAR and PUMP CO., Inc.
9257 HUDSON BLVD., NORTH BERGEN, N. J.

Also Manufacturers of Gearex Pumps, Precision Gears and Flexible Gear Couplings

Coming June 15:

the 1952 POWER Buyers' Guide

● Lists more than 1,000 firms that make power-field equipment. Tells you where they are and what they make

● Reviews new equipment Makes it easy for you to send for catalogs and bulletins

● Brings you up-to-date on changes among manufacturers

Here's one issue you'll want to keep within arm's reach, the year 'round

The 1952 BUYERS' GUIDE *is coming June 15*

MIDWEST PREFABRICATED PIPING

SAVES LABOR

SAVES TIME

SAVES MONEY

SAVES TROUBLE

From A Simple Bend

Or Welded Assembly

To Complete Piping Systems For Power Plant

Or Process *Call On MIDWEST*

Midwest Shop-Fabricated Piping saves labor, time, money and trouble in erection. Subassemblies are always practical, with the difficult operations performed in the fabricating plant. Field welding is simplified as much as possible. All pieces are accurate in alignment and dimension . . . they are thoroughly cleaned to remove all scale and dirt . . . carefully inspected and tested . . . stress relieved when necessary . . . ready to erect quickly, easily at lowest cost. It is to your advantage to use Piping Prefabricated by Midwest.

MIDWEST PIPING SERVICE IS NATION-WIDE

4 Plants Are Better Than 1

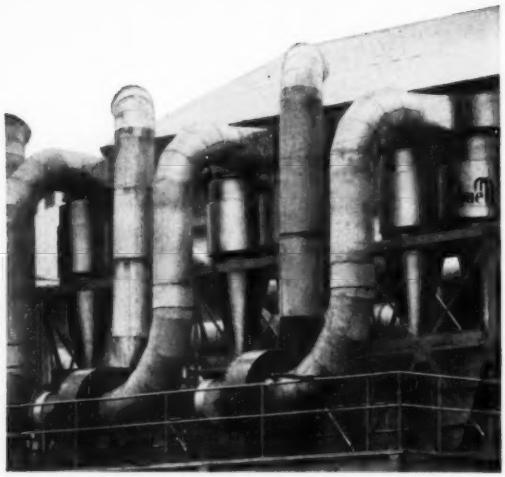
PIPING FABRICATORS AND CONTRACTORS

MIDWEST PIPING & SUPPLY CO., INC.

Main Office: 1450 South Second Street, St. Louis 4, Mo.

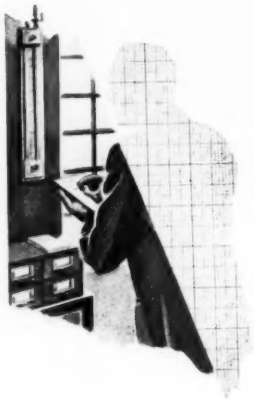
Plants: St. Louis, Passaic, Los Angeles and Boston

Sales Offices: New York 7—50 Church St. • Chicago 3—79 West Monroe St.
Los Angeles 33—320 Anderson St. • Houston 2—1213 Capitol Ave.
Tulsa 3—234 Wright Bldg. • Boston 27—436 First St.



Buell Cyclones installed in series to collect nuisance dust at a steel plant. High efficiency operation is assured by exclusive 'Shave-off' feature.

Worrying About Fly-Ash Discharge?



This industrial 'dust' man can help determine the Dust Abatement System most efficient for you!

The Buell organization of industrial 'dust' men is devoted solely to the design and construction of dust collection equipment that will most efficiently and economically solve your plant's specific Stack Dust problem.

For more than 18 years we have been doing just this for all American industry. Every Buell installation is a custom-designed system, engineered to hold stack dust discharge down to the practical limits which assure improved product and/or process, better plant-community relations, higher levels of employee morale.

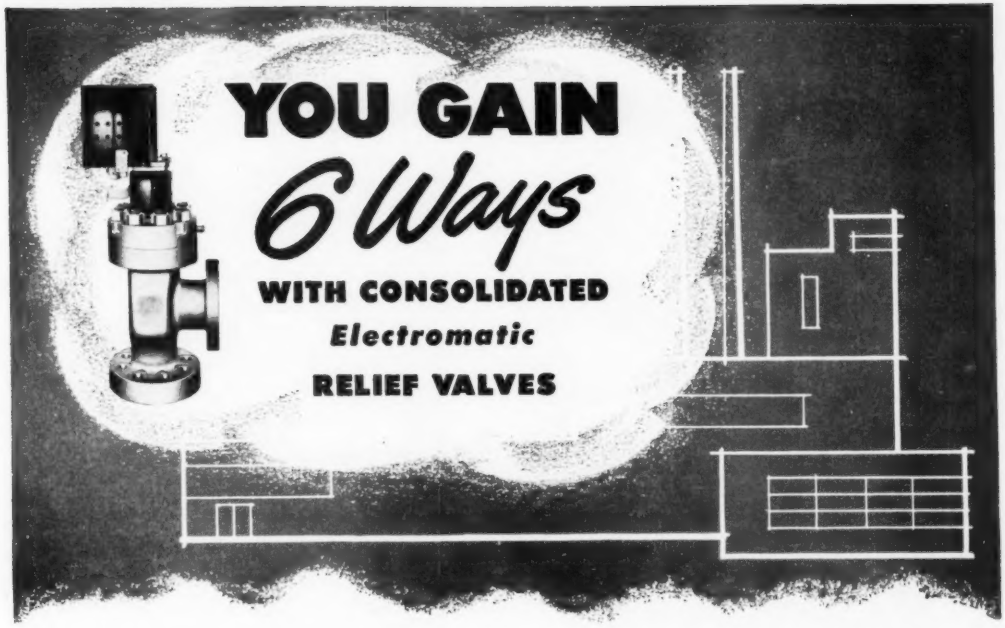
For full information about Buell's ***3 basic systems*** of dust collection, and how one can be applied to the solution of your stack dust problems, write today. Ask for the new informative bulletin titled, "The Collection and Recovery of Industrial Dusts." Do it now. Buell Engineering Co., Dept. 50-E, 70 Pine Street, New York 5, N. Y.

buell®

ELECTRIC CYCLONIC

HIGH EFFICIENCY CYCLONES • ELECTRIC PRECIPITATORS
TYPE 'LR' COLLECTORS • LOW DRAFT LOSS COLLECTORS
SPECIAL PURPOSE COLLECTORS • DUST HOPPER VALVES

ENGINEERED EFFICIENCY IN DUST COLLECTION



The Consolidated Electromatic is an automatic, electrically actuated, pressure relief valve for boiler service. It can be set for 1% or less differential between opening and closing pressure — relieves pressure precisely within close limits. A switch or a pressure-sensitive element is used to actuate the solenoid which operates the valve.

The valve can be operated automatically, manually or cut out of service entirely by setting the switch. The entire cyclic action is practically instantaneous. High superheat temperatures or other variables do not affect the valve operation.

The Consolidated Electromatic can also serve as a superheater surge vent valve or to purge a superheater or a header — reduces the possibility of damaging the seats of regular valves and turbine equipment. Because it can be operated manually at any pressure, positive circulation is guaranteed through the superheater and greater steam flows are obtained than normally possible by the vent valves, during start-up periods. This minimizes the danger of burning superheater tubes.

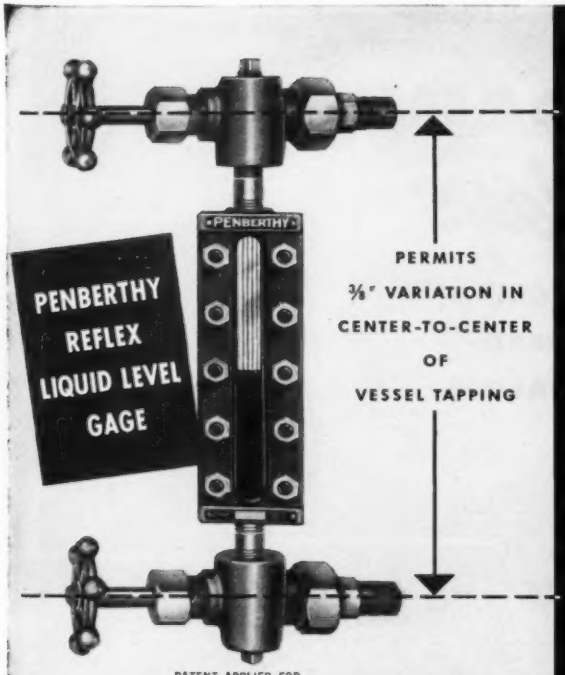
With the installation of a Consolidated Electromatic Relief Valve, you are assured of: (1) more accurately balanced boiler operation at peak loads; (2) more uniform line pressure; (3) power conservation; (4) less maintenance of spring-loaded safety valves; (5) greater protection against overheating the superheater because it provides additional flow through the superheater under all conditions of operation; (6) increased efficiency of the steam generating plant.

CONSOLIDATED
Electromatic
RELIEF VALVE
Sizes: 2½", 4", 10", 14"
Pressures: Up to 2500 p.s.i.
Temperatures: Up to 1100°F.
Standard Connections: A.S.A. flanged and welded.

Detailed information about the installation and operational features of Consolidated Electromatic Relief Valves is yours on request.

CONSOLIDATED SAFETY VALVES

A product of **MANNING, MAXWELL & MOORE, INC.** STRATFORD, CONN.
MAKERS OF 'CONSOLIDATED' SAFETY AND RELIEF VALVES, 'AMERICAN' INDUSTRIAL INSTRUMENTS, 'HANCOCK' VALVES, 'ASHCROFT' GAUGES. BUILDERS OF "SHAW-BOX" CRANES, 'BUDGIT' AND 'LOAD LIFTER' HOISTS AND OTHER LIFTING SPECIALTIES.



PATENT APPLIED FOR

Another PENBERTHY First

PENBERTHY "Floating Shank"

Saves Time and Money in Gage Installation

A feature available only on Penberthy drop forged steel (and alloy) gage valves, the "floating shank" automatically compensates for as much as 3/8" variation in the center-to-center distance of the vessel tapping. This saves time and cuts the cost of gage installation . . . eliminates stresses often induced during mounting. Penberthy "floating shank" is available at slight additional cost. It will pay you well to specify "floating shank" on your next gage order.

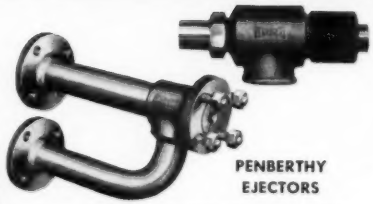
OTHER PENBERTHY PRODUCTS

PENBERTHY TRANSPARENT GAGE

Used to observe color and density of liquids under high pressures and/or temperatures. Exceptionally sturdy construction—liquid chamber machined from solid block of metal. Ask for Catalog 35.

PENBERTHY CYCLING JET PUMPS

Automatically operated by air, gas or steam pressure . . . Will pump without clogging any liquid that will flow through pipes. Ask for Bulletin 5030.



PENBERTHY EJECTORS

A simple jet pump operated by air, water or steam. Needs no lubrication . . . will not get out of order. Made in wide variety of materials and special units developed to meet unusual conditions. Ask for Bulletin 512.

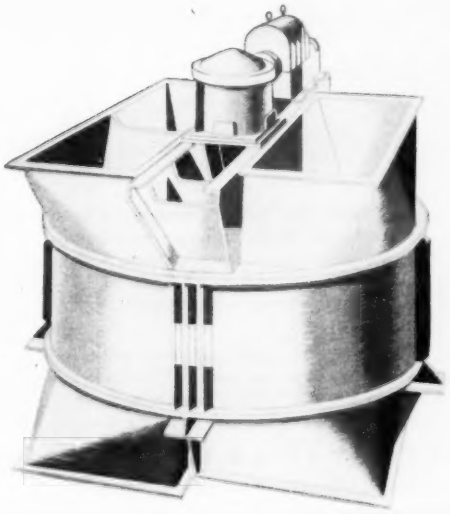
4671

PENBERTHY INJECTOR COMPANY
DIVISION OF THE BUFFALO-ECLIPSE CORPORATION
DETROIT 2, MICHIGAN

Established 1886 — *Canadian Plant, Windsor, Ontario*

this preheater is cutting fuel costs in hundreds of plants!

The Ljungstrom operates on the continuous regenerative counterflow principle. The heat transfer surfaces in the rotor act as heat accumulators. As the rotor revolves the heat is transferred from the waste gases to the incoming cold air.



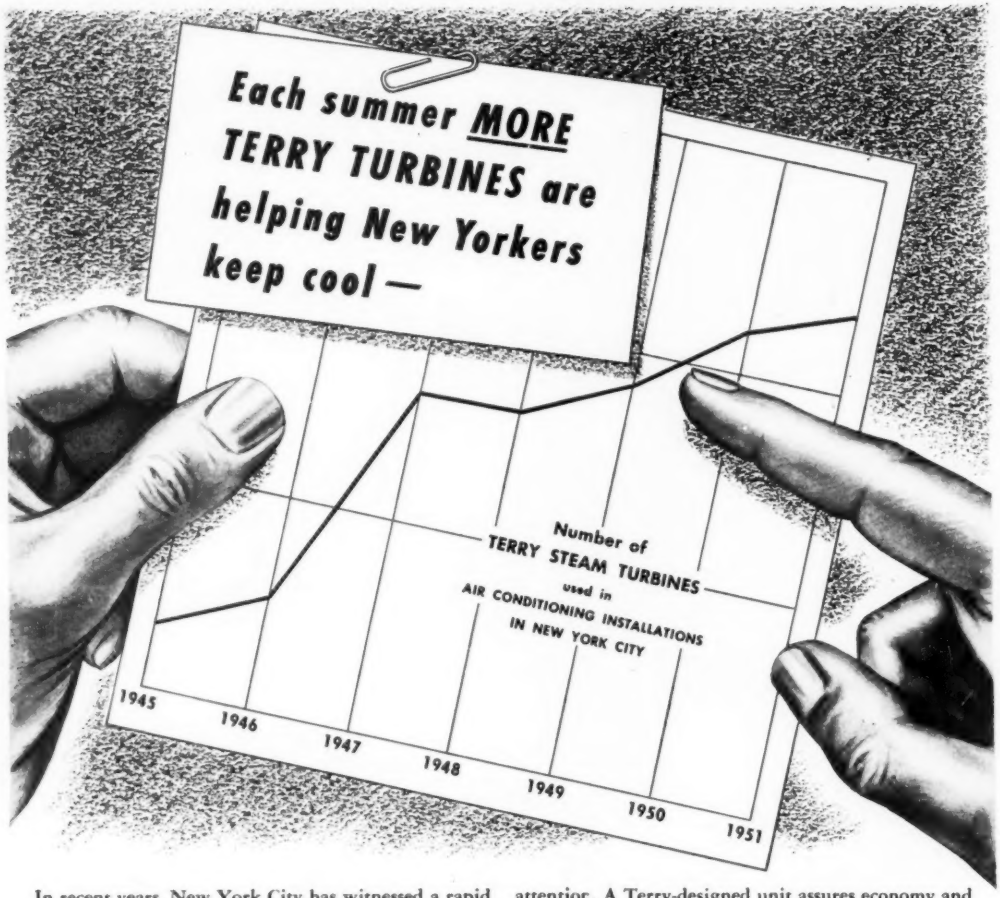
The Ljungstrom air preheater has proved its value in industrial and utility plants throughout the country. That is why every year a constantly increasing percentage of the installed boiler capacity is equipped with Ljungstrom air preheaters.

***Your* fuel costs will be lower too, when your boiler is equipped with the Ljungstrom air preheater. The regenerative design of the Ljungstrom permits reliable operation at low exit gas temperatures. This assures the greatest possible heat recovery . . . reduces the amount of fuel required.**

If you are planning a new installation, or expanding your present one, our engineers will welcome the opportunity to show you how the Ljungstrom air preheater can raise the overall efficiency of *your* plant.

THE AIR PREHEATER CORPORATION

60 East 42nd Street, New York 17, N. Y.



In recent years, New York City has witnessed a rapid gain in the number of air-conditioning installations providing comfort cooling by means of steam. And, as the accompanying chart shows, TERRY STEAM TURBINES have figured prominently in this relatively recent development.

TERRY TURBINES make an ideal prime mover for driving the refrigerating compressor. They respond automatically to the temperature requirements, and will cut back to as little as 15 percent of rating without attention. A Terry-designed unit assures economy and ease of operation.

Before you make a decision on your air-conditioning installation, why not call in a Terry representative? He will be glad to explain the benefits of *comfort cooling by steam.*

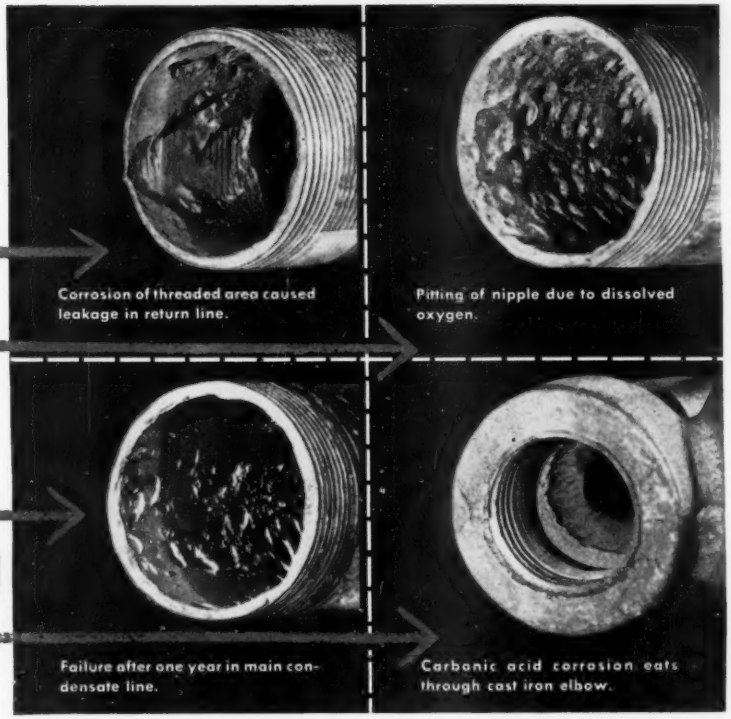
PARTIAL LIST OF TERRY TURBINE INSTALLATIONS IN NEW YORK CITY
Best & Co. • Bloomingdale Bros. • Book-of-the-Month Club Carbide & Carbon Building • Federal Reserve Bank • Lord & Taylor • Macy's New York • Madison Square Garden James McCreery & Co. • Mutual Life Insurance • Port Authority Bus Terminal • The 260 Madison Avenue Building

THE TERRY STEAM TURBINE CO.

TERRY SQUARE, HARTFORD 1, CONN.

TT-1192

victims of Return Line Corrosion



Corrosion of threaded area caused leakage in return line.

Pitting of nipple due to dissolved oxygen.

Failure after one year in main condensate line.

Carbonic acid corrosion eats through cast iron elbow.

Dearborn Formula 702 will prevent Corrosion caused by low pH values

Excessively low pH values of water—caused by dissolved carbon dioxide—result in corrosion that destroys return line sections such as these.

The destruction of such valuable parts is easily and economically prevented with Dearborn Formula 702. Introduced directly into the boiler feed water, Formula 702 forms a continuous amine-type film on the return lines to effectively coat the lines against corrosion. In addition, Formula 702 will automatically repair any surface where the film has been broken by loosened rust scale, and also improve heat transfer in the line, thereby reducing the cost of steam production.

Your Dearborn Engineer will gladly demonstrate how you can reduce the cost of maintenance and avoid shutdowns with Dearborn Formula 702. Why not call him today?

DEARBORN CHEMICAL COMPANY

Merchandise Mart Plaza • Chicago 54, Illinois

BASIC PATENTS

Dearborn holds the basic patents (U.S.Pat. 2400543) for the use of filming amines for treating water.

YOU'LL WANT A COPY OF THIS BULLETIN Bulletin 5013, which outlines the causes of return line corrosion and the method of cure with Formula 702, will be sent on request.

Dearborn Chemical Company Dept. PO
Merchandise Mart Plaza
Chicago 54, Ill.

☐ Send a copy of Bulletin 5013
☐ Have a Dearborn Engineer call

Name.....

Position.....

Company.....

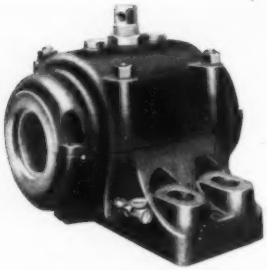
Address.....

City.....*Zone*.....*State*.....

Dearborn

TRADE MARK REGISTERED

THE LEADER IN WATER TREATMENT AND RUST PREVENTIVES



SLEEVOIL
IS THE BEARING

—for Accessibility and Long Life!

For important line shaft installations, where operations will not permit dismantling to service a bearing, the Dodge Sleevoil is definitely superior. Housings and liners are of split design. Liners can be changed with an absolute minimum of down time.

Here is a super-quality, precision built, ring oiling, babbitted bearing which combines accessibility and long life to a degree that is unique in the bearing field.

Dodge Sleevoil Pillow Blocks have a long record of dependable performance in critical service—in the nation's great generating plants, in unusual fan and blower service, in big paper mills—in many continuous-operation fields where power *must not fail.*

Dodge Sleevoil Bearings are normally available from distributors' stocks—in both plain and water-cooled types, in shaft sizes from 1-7/16″ to 8″. *WRITE* for information.

DODGE MANUFACTURING CORPORATION
3200 Union Street • Mishawaka, Indiana

Sleevoil bearings on a line shaft in one of America's largest paper mills. Maintenance man is checking sight oilers.

DODGE
of Mishawaka, Ind.

CALL THE TRANSMISSIONEER, your local Dodge Distributor. Factory trained by Dodge, he can give you valuable assistance on new cost-saving methods. Look for his name under "Power Transmission Equipment" in your classified phone book.

SEALED-LIFE V-BELTS AND TAPER-LOCK SHEAVES

DODGE-TIMKEN PILLOW BLOCKS

ROLLING GRIP AND DIAMOND D CLUTCHES

NAME PLATES

FOR YOUR NAME PLATE REQUIREMENTS, WRITE OUR SUBSIDIARY, CHICAGO THRIFT-ETCHING CORPORATION, 1555 SHEFFIELD AVENUE, CHICAGO 22, ILLINOIS

NEW Standards

IN SPEED and SIMPLICITY OF COAL UNLOADING

This Mead-Morrison Unloader was purchased for a free digging rate of 600 tons per hour . . . but it is regularly handling more than 700 tons of coal per hour from barge to hopper.

And the machine excels in simplicity as well as in capacity. It provides an ease and smoothness of grab bucket control . . . both in free digging and in barge clean-up operations . . . never before obtainable in a machine operating on alternating current.

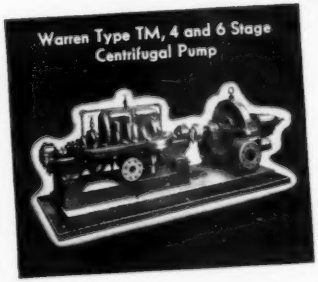
Write for full information on the distinctive Mead-Morrison features that can increase the speed and improve the efficiency of your coal-unloading.

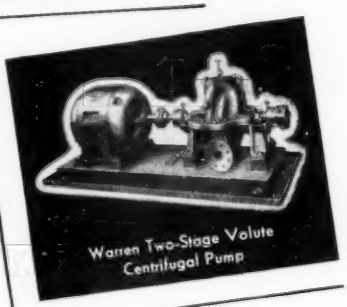
MEAD-MORRISON

Division of McKIERNAN-TERRY CORPORATION . *Manufacturing Engineers*

HARRISON, NEW JERSEY

a boiler plant
is no more dependable than its
Feed pumps....





P-28

For well over half a century Warren has specialized in this field and has kept pace with boiler feed requirements as they have developed over the years.

As builders of both Centrifugal and Reciprocating types and for light, medium and higher pressure services, there is a thoroughly dependable Warren Pump to meet a very large part of all boiler feed conditions.
Their on-the-job record has long been one of reliable, low cost operation.

Time-Tested Experience Indicates it is Good Business

to Specify **WARREN PUMPS**

WARREN QUIMBY PUMPS

WARREN STEAM PUMP COMPANY, INC., WARREN, MASSACHUSETTS

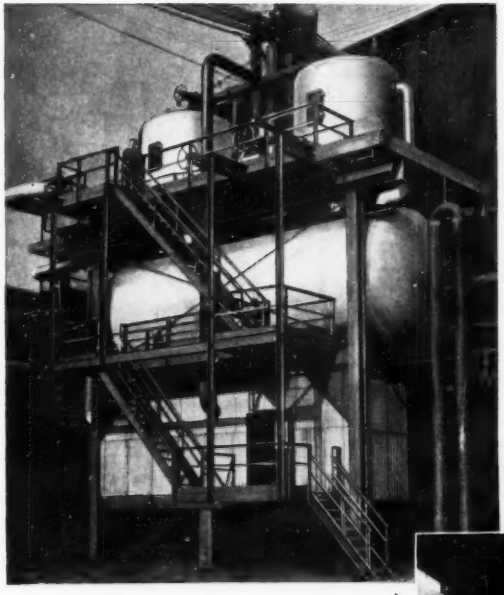
Centrifugal . . . . . Reciprocating . . . . . Rotary

GRAVER

Deaeration for all!

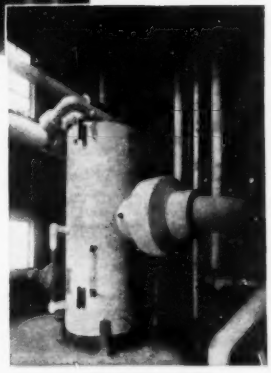
from under 5,000 lb per hr
to over 1,000,000 lb per hr

Whether your plant is large or small, the wide range of Graver Deaerating Heaters assures a correct selection for your particular operating conditions. Graver Heaters are available in spray or tray types, or a combination spray-tray type, equipped with either external or internal vent condensers.



← For the large capacity plant

Graver Deaerating Heaters are serving high-pressure high-temperature central power stations and large industrial plants all over the country. Even with difficult operating conditions such as variable load and corrosive water, Graver installations uniformly exceed guarantees and operate with complete satisfaction, minimum attention, and negligible maintenance expense.



→ for the small capacity plant

Standard designs of Graver small Deaerating Heaters are specially engineered for the same low-oxygen guarantee carried by the larger and more expensive Graver Heaters. These small Graver units provide complete deaeration at a low cost that is quickly returned by savings in plant operation, maintenance and outage costs.

Investigate Graver Deaerator corrosion protection for your plant. Specific recommendations are offered without obligation. Write for your copy of "Trends in Application of Deaerating Heaters for Treatment of Boiler Feedwater".

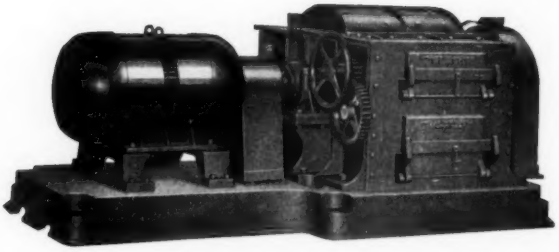
GRAVER WATER CONDITIONING CO.
Division of Graver Tank & Mfg. Co., Inc.
216 WEST 14th STREET, NEW YORK 11, N. Y.

GW 482

FOR LESS THAN

AMERICANS WILL CRUSH

1 TON OF COAL



Based on Case Histories Involving 61,000,000 Tons of Coal

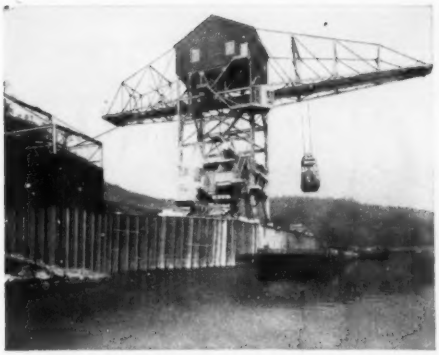
Costs include . . . Depreciation, Maintenance, Replacement parts, Interest on Investment, and Power

There can be no better proof of the Built-in QUALITY of AMERICAN CRUSHERS.

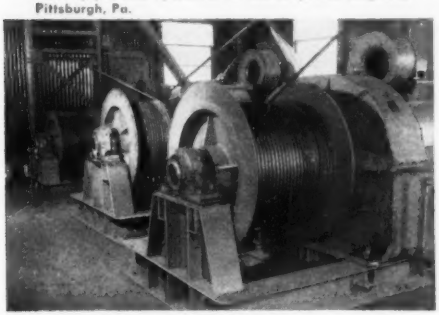
American PULVERIZER COMPANY

Originators and Manufacturers of Ring Crushers and Pulverizers

1349 MACKLIND AVE.
ST. LOUIS 10, MO.



This 720 ton-per-hour Barge Unloader . . . designed, fabricated and erected by Heyl & Patterson . . . was recently put into operation for the Duquesne Slag Co., Pittsburgh, Pa.



The Close Drum and the Hold Drum (right and center), which raise, lower, open and close the bucket, are operated by two 200 H.P. motors. The Trolley Drum (left) is operated by one 100 H.P. motor.

All motions of the Trolley and Bucket are easily controlled by a single operator.

ADVANCED DESIGN
is the RESULT of
COOPERATIVE PLANNING

by Heyl & Patterson

The improvement of Heavy Bulk Materials Handling Equipment for the world's major industries . . . Steel, Mining, Power, Transportation, Aluminum . . . calls for Engineers, Fabricators and Erectors instilled with the urge for constant improvements . . . improvements based on actual past experience and on modern thinking and planning . . . with the one thought of building better equipment.

Heyl & Patterson is fortunate in having men of this type . . . men who realize that improvements come only as the result of experimenting in the engineering department, in the research department and in the field.

Heyl & Patterson Engineers have to be specialists in Heavy Bulk Materials Handling Equipment because they have undivided responsibility for the successful operation of all H&P projects.

Complete cooperation for our design engineers is assured because we have ***Our Own*** Engineering Department . . . ***Our Own*** Research Department . . . ***Our Own*** Structural Shop . . . ***Our Own*** Machine Shop . . . ***Our Own*** Erection Department.

Every man on our Sales Staff is an experienced, practical engineer with a firm belief in the need of advanced design. Their first duty is to understand your problems. Then it is the duty of every member of the H&P organization to see that you get complete cooperation . . . all the Way, from the original design to the successful operation of your equipment.

Heyl & Patterson can guarantee ***Controlled Low Cost*** because every phase of any Heavy Bulk Materials Handling Equipment Job can be produced entirely within ***Our Own*** organization.

Ore Bridges
Railroad Car Dumpers
High Lift-Turnover-Rotary
Coal Preparation Plants
Coal & Coke Handling Equipment
Boat Loaders and Unloaders
Rotary Mine Car Dumpers
Coal Crushers
Coal Storage Bridges
Car Hauls and Boat Movers
Bradford Breakers
Refuse Disposal Cars
Thorsten Coal Sampling Systems
Kinney Car Unloaders
Pig Iron Casting Machines
Cyclone Thickeners
Thermal Dryers
The Drying Dutchman
Reineveld Centrifugal Dryer

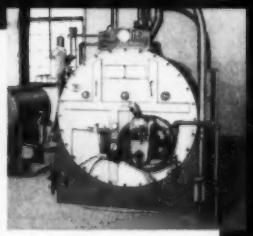
Heyl+Patterson, Inc.
"SINCE 1887"

Heavy Bulk Materials Handling Equipment
All The Way from Design to Erection

55 WATER STREET • PITTSBURGH 22, PA.

You are cordially invited to take a four-plant tour to inspect "packaged" EconoTherm Installations

. . . see how much OWNERS SAVE on fuel and labor with Dutton BOILERS



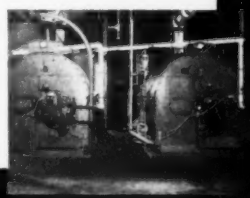
BIG RAILROAD SAVES $5,000 YEARLY WITH ECONOTHERM!

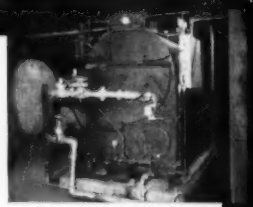
Talk first to roundhouse officials of one of America's greatest railroads*. One Dutton EconoTherm, used for roundhouse heating and hot water supply through *just the colder months each year* has made actual savings pegged at $5,000 per year! Automatically operated, it needs but a few minutes' checking daily. Former equipment required 24-hour-per-day attention.

* Name on request

STOKELY-VAN CAMP, INC., FINE FOOD PACKERS, LIKES ECONOTHERM'S FLEXIBILITY, ECONOMY

At Lakeland, Minn., stop at the sign of Stokely's Finest Foods and World Famous Van-Camp's Pork & Beans. H. H. Young, Chief Engineer, says: "The flexibility of Dutton Boilers fits well into our needs. We have a saving in boiler room labor . . . It is possible to operate with 50% less labor than previously . . . Particularly pleased with service rendered by your representatives."





ECONOTHERM UPKEEP IS ALMOST NIL AT THE CENTURY BRICK CO., MONROE, LA.

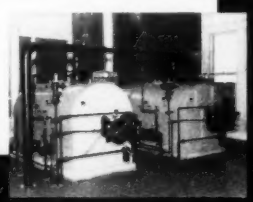
J. P. Humble, owner, can show you a gas-fired EconoTherm used around the clock, 5 or 6 days weekly, in curing sand lime brick and new, light building blocks. "In use since 1948 . . . upkeep cost practically nil . . . only shutdowns due to annual inspection or minor repairs of other machinery . . . could not make a more satisfactory purchase than a Dutton EconoTherm."

AT EVANSVILLE, INDIANA, THE WATER WORKS PLANT SUPT. SAYS "WELL PLEASED!"

And there are hundreds of others!

To get more facts first-hand, why not talk to Dutton owners near you? Contact Dutton — or ask your nearby Dutton Representative for the location of installations you can tour yourself! When you write, ask for EconoTherm Bulletin EC-100C*

* See Yellow Pages in Phone Book.



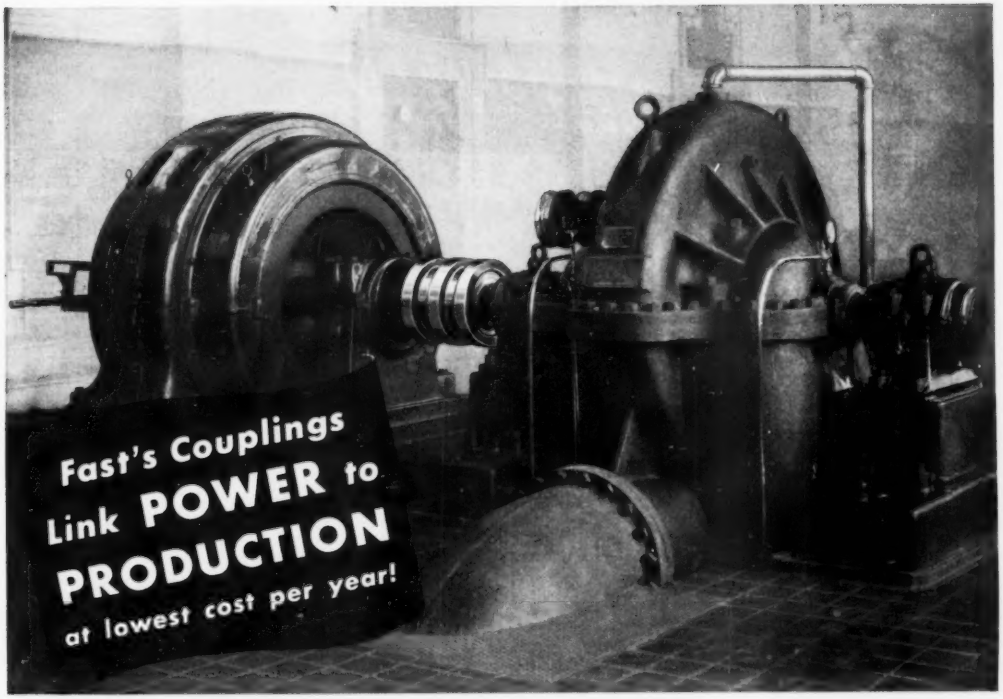
Dutton BOILERS

CHECK FIRST with Dutton

DIVISION HAPMAN-DUTTON COMPANY

KALAMAZOO, MICHIGAN • BOILER BUILDERS SINCE 1880

FOUR TYPES — SIZES FROM 5 H.P. UP



FAST'S Couplings usually outlast the equipment they connect!

ACTUAL cases on record show many Fast's Couplings are still in service after as much as 30 years of continuous operation! Time and time again, equipment has been replaced while the original Fast's Coupling remained on the job.

To you, these records of dependable, trouble-free service mean freedom from costly coupling failures when you specify Fast's. And they mean Fast's cost you far less to own and operate . . . because their cost can be amortized over long years of dependable performance.

For full details on how Fast's Couplings and Koppers Engineering Service can help you, write today for a free copy of our catalog to: KOPPERS COMPANY, INC., *Fast's Coupling Dept.*, 225 Scott St., Baltimore 3, Maryland.

Here's How FAST'S Save You Money

Free Service—Koppers free engineering service assures you the right coupling for the job.

Rugged Construction—Fast's still maintains its original design, without basic change or sacrifice in size or materials. Result: freedom from expensive coupling failures.

Lowest Cost per Year—Fast's Couplings usually outlast equipment they connect. Their cost may be spread over many years!

KOPPERS

FAST'S
THE ORIGINAL
GEAR-TYPE
Couplings

INDUSTRY'S STANDARD FOR 32 YEARS

KOPPERS COMPANY, INC., ***Fast's Coupling Dept.,***
225 Scott St., Baltimore 3, Md.

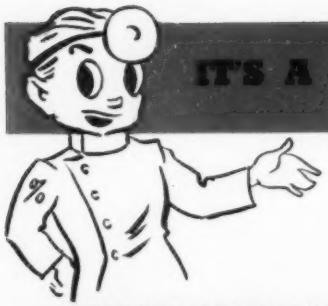
Gentlemen: Send me Fast's Catalog which gives detailed descriptions, engineering drawings, capacity tables and photographs.

Name .....

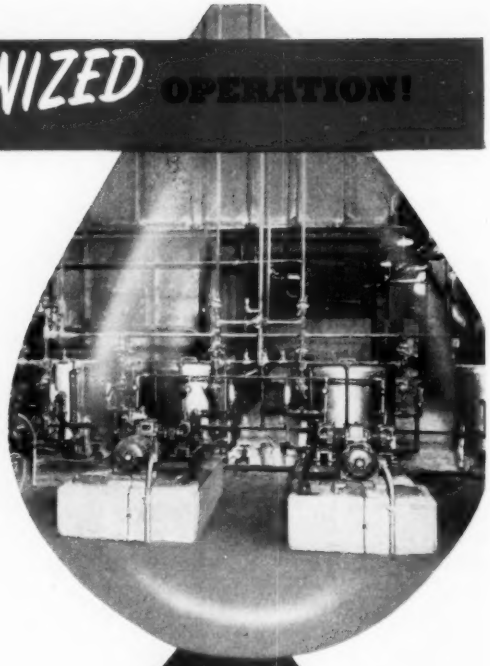
Company .....

Address .....

City ..... *Zone* ..... *State* .....



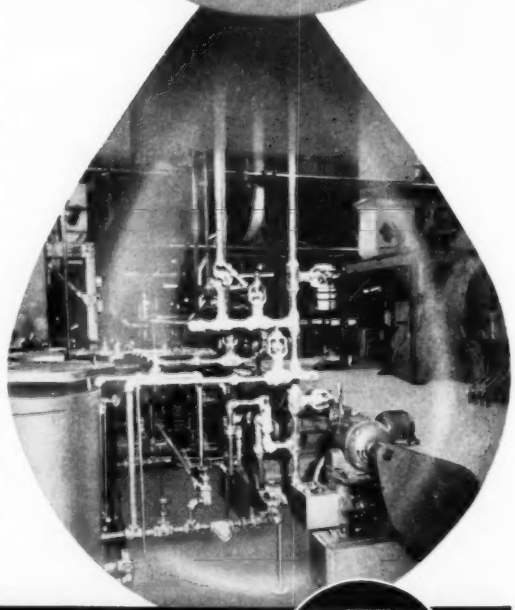
IT'S A *MECHANIZED* OPERATION!



%PROPORTIONEERS% Boiler Water Conditioning System is Positive Protection for the Boiler

%Proportioneers% installations automatically provide correct boiler water conditions, adding the proper treating chemical in proportion to demand. %Proportioneers% chemical treating systems reduce boiler maintenance, minimize operator responsibility and provide positive control of chemical application. Shown here is a %Proportioneers% installation at the Georgia Power Company's 300,000-kilowatt generating station near Newnan, Ga.

We can supply either *constant rate* or *flow responsive* chemical feeding systems for every type of power plant from the largest high pressure installation to the smallest low pressure job. These systems include metering pumps, control panels, timers, feeding and flushing valves, chemical tanks, dissolvers and auxiliary equipment such as flow meters incidental to automatic control of chemical treatment. Let %Proportioneers, Inc.% assume full responsibility for your complete chemical feeding system. Write for Brochure SM-9020 and Bulletin CAT.

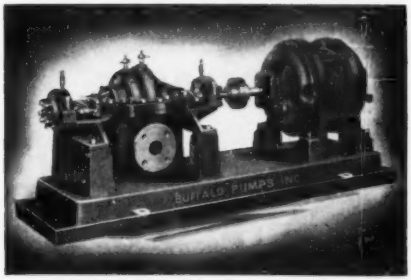


% PROPORTIONEERS, INC. %

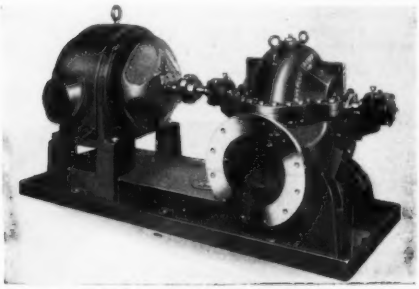
Write to %Proportioneers, Inc.%, 354 Harris Avenue, Providence 1, R. I. Technical service representatives in principal cities of the United States, Canada, Mexico and other foreign countries.

"Buffalo" Tips on Better Pumping

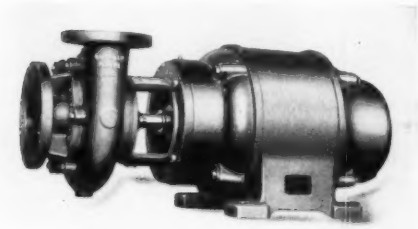
REGULAR PREVENTIVE MAINTENANCE



FOR BOILED FEED or other high pressure or clear water service. Buffalo Type "RR" Pumps have proven themselves to be high in efficiency and easy to maintain 2- and 4-stage models, up to 900 gpm capacities.



"Buffalo" Type "SL" Double Suction Pumps are among the most popular for humidifier and air washer service.



CLOSE-COUPLED for cramped quarters! The Type CCL Pump is one of many models to suit specific needs.

Keeps Your Pumps Performing!

• Even the best constructed pumps require regular servicing for efficient performance and long life.

The best way to insure the success of a preventive maintenance program is to set up a regular schedule for servicing and inspection. A qualified engineer who knows pumps and lubricants should be the one to set up this schedule.

The schedule would call for at least four inspections of each pump annually, to check on bearings, shaft alignment, packing, impeller and lubrication. The inspector makes a report of any conditions which need correcting —conditions requiring servicing, to the operating group; conditions requiring repairs, to the maintenance group. (Often, these reports prevent minor conditions from developing into major troubles.)

The schedule for lubrication, as well as any operating instructions, should be posted plainly on or near each pump.

This is another in a series of messages by Buffalo Pumps, Inc. in the interest of conserving materials and industrial equipment.

"Buffalo"

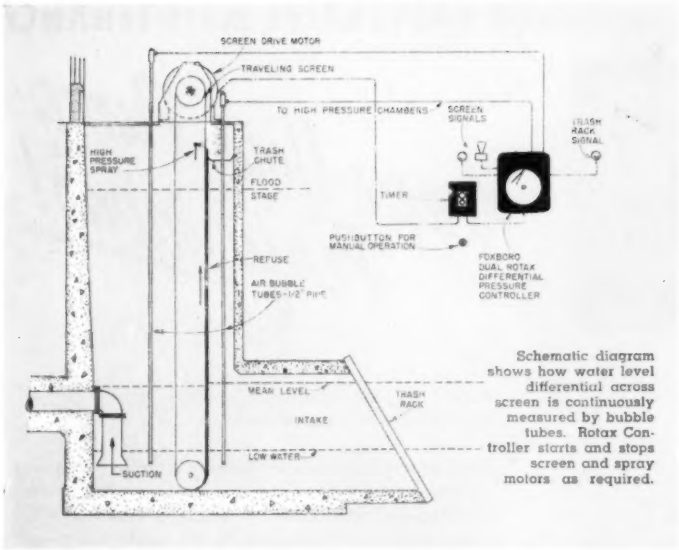
BUFFALO PUMPS INC.

488 BROADWAY BUFFALO, NEW YORK

Canada Pumps, Ltd., Kitchener, Ont. Sales Representatives in all Principal Cities

A BETTER CENTRIFUGAL PUMP FOR EVERY LIQUID

Make traveling intake screens positively "Plug-Proof"



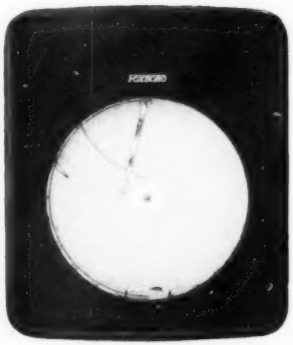
Schematic diagram shows how water level differential across screen is continuously measured by bubble tubes. Rotax Controller starts and stops screen and spray motors as required.

. . . with Foxboro liquid level type screen control

Make sure your intake suction well can't go dry when excessive refuse suddenly piles up on the traveling intake screen!

The Foxboro Traveling Screen Control System automatically starts the screen-rotating motor and the cleansing spray whenever refuse accumulation causes the water level difference between opposite sides of the screen to exceed a certain preset valve. Quickly, it purges the screen of refuse and restores the intake level to normal — or sounds an alarm indicating that the cleaning mechanism is unable to cope with the difficulty. What's more, this action takes place only when the screen actually becomes clogged . . . no waste of power or unnecessary wear on mechanism through needless periodic operation.

The Foxboro Traveling Screen Control System is easy to install, inexpensive to operate, and pays big dividends in better intake operation, less maintenance and greater peace of mind. Write for complete information. **The Foxboro Company, 685 Neponset Ave., Foxboro, Mass., U.S.A.**



ROTAX Liquid Level Controller. The heart of the system, translates level differential into operation of motors. In addition, it can operate warning horn or light in case of unusually severe fouling. Circular or rectangular case models.

FOXBORO REG. U. S. PAT. OFF.

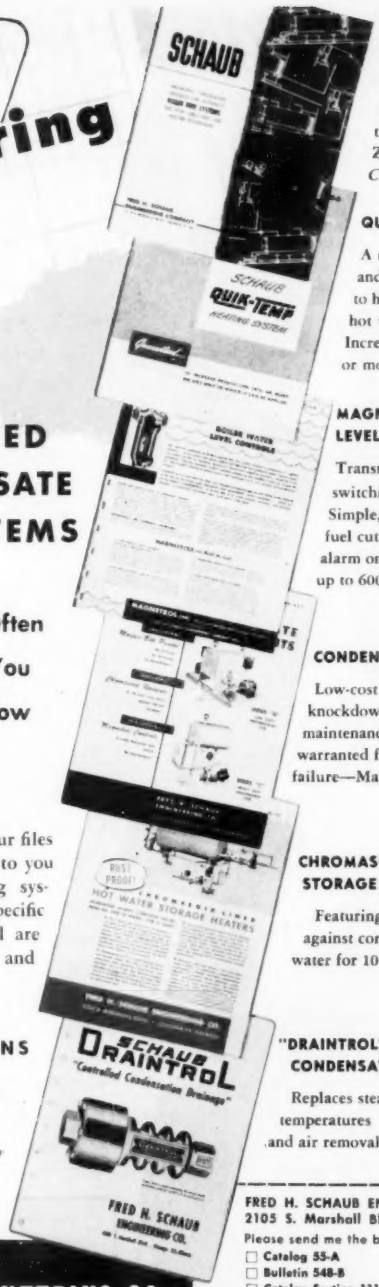
INSTRUMENTATION
INDICATING · RECORDING · CONTROLLING

Free Engineering Data

on BOILER FEED and CONDENSATE RETURN SYSTEMS

Information That is Often Hard to Find When You Need it . . . Get it Now and Keep it Handy

This information belongs in your files It will be of inestimable help to you when planning or specifying systems or components to do specific jobs most efficiently. Included are complete engineering data and specifications on:



ENGINEERING BULLETINS

"A Discussion of Deaerator Design Principles," covering design intent, basic requirements, and other considerations. *Engineering Bulletin 570.*

Engineering Notes for Storage Hot Water Heaters. How to determine the proper heater for specific applications. *Engineering Bulletin No. 911.*

ENGINEERED CONDENSATION DRAINAGE AND AUTOMATIC BOILER FEED SYSTEMS:

Standard boiler return systems—Pree-Heet Systems—Heat reclaim systems—Spray type deaerating systems—Zero oxygen deaerating systems. *Catalog 55-A.*

QUIK-TEMP HEATING SYSTEMS:

A method of continuous stream circulation and air removal that permits machines to heat almost instantly and keeps them hot with minimum effect from load change. Increases production potential 10% or more. *Bulletin 548-B*

MAGNETROL BOILER WATER LEVEL CONTROLS:

Transmits changes in water level to the switching mechanism by magnetic action. Simple, fool-proof, positive. May be used for fuel cut-off and alarm, cut-off only or alarm only. Models for all steam pressures up to 600 pounds. *Catalog Section 111.*

CONDENSATE RETURN SYSTEMS:

Low-cost prefabricated type and heavy duty knockdown type. Featuring Master-Bilt maintenance-free pumps—Chromasoid receivers, warranted for 10 years against internal corrosion failure—Magnetrol controls. *Bulletin 655.*

CHROMASOID LINED HOT WATER STORAGE HEATERS:

Featuring Chromasoid lined tanks guaranteed against corrosion failure from any kind of water for 10 years. *Bulletin 910.*

"DRAINTROL" FOR CONTROLLED CONDENSATION DRAINAGE:

Replaces steam traps. Enables higher surface temperatures by continuous condensation drainage and air removal. *Bulletin 642.*

FRED H. SCHAUB ENGINEERING CO.
2105 SO. MARSHALL BLVD.
CHICAGO 23, ILLINOIS

FRED H. SCHAUB ENGINEERING CO.
2105 S. Marshall Blvd., Chicago 23, Ill.

Please send me the bulletins checked below:

- ☐ Catalog 55-A
- ☐ Bulletin 548-B
- ☐ Catalog Section 111
- ☐ Engineering Bulletin 570
- ☐ Bulletin 655
- ☐ Bulletin 910
- ☐ Bulletin 642
- ☐ Engineering Bulletin 911

NAME_____

COMPANY_____

ADDRESS_____

CITY_____ ZONE____ STATE_____

"For high dust collection efficiency CONSIDER THESE FACTS!"

95% to 99% REMOVAL

Your specific needs determine the exact percentage of fly ash removed by a Research Corporation Cottrell Precipitator.

LOW DRAFT LOSS

The pressure drop between inlet and outlet of the Cottrell is extremely low, averaging *only a few tenths of an inch of water.*

DURABILITY

Low velocities hold abrasion to a minimum.

ANY CAPACITY

Cottrell precipitators have been used successfully with both small boilers and the very large boilers developed in recent years.

OTHER APPLICATIONS

Cottrell precipitators have wide application in the recovery of other materials such as acid mist, blast furnace dust, sodium salts, fluid catalyst and valuable metals from smelters.

YOU GET all these important advantages PLUS Research Corporation's 38 years of experience in the field of electrical precipitation. Every Cottrell installation is individually engineered to do the most efficient job. For more facts about Research-installed Cottrells, send for Bulletin 500.

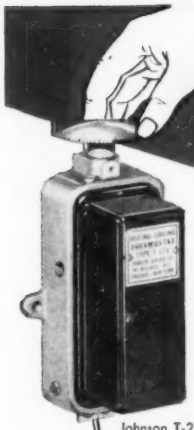
RESEARCH CORPORATION

405 Lexington Avenue, New York 17, N. Y.
122 South Michigan Avenue, Chicago 3, Illinois

The chances are...

a building like
525 William Penn Place
would be equipped with

Johnson CONTROL



Johnson T-271 Heating-Cooling Thermostat for air conditioning units.

An office in the 525 William Penn Place building, Pittsburgh, Pennsylvania.
Harrison & Abramovitz, New York, and William Y. Cocken, Pittsburgh, architects;
Dravo Corp., Pittsburgh, heating & air conditioning contractors.

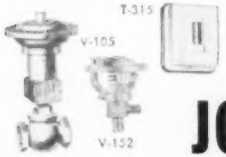
In building after building, Johnson is called upon to furnish and install dependable automatic temperature and humidity control for modern air conditioning systems. No matter what the extent of the problems involved, the chances are that they will be turned over to the nation-wide Johnson organization.

In Pittsburgh's newest skyscraper, 1,650 year-around air conditioning units provide all-weather comfort in each exterior room. A Johnson T-271 Heating-Cooling Thermostat is located in one of the units in each room, with its temperature bulb mounted close behind the recirculating air grille to respond quickly to the average temperature of the air entering the units. Thus, the Johnson V-152 valve, on the hot and cold water supply to the coil in each unit, is operated to determine automatically the heating or cooling effect to be applied.

The interior areas in the building are served by 51 central-type air conditioning systems, and 105 Johnson T-315 Submaster Room Thermostats control Johnson V-105 coil valves on the steam supply to booster heaters.

In addition to the *Individual Room* control, there is comprehensive Johnson Master Control, "behind the scenes", to regulate temperatures and humidities for the 10 systems which supply primary air to the units, as well as the conditioned air delivered by the 51 central systems which serve the booster heaters in the interior sections.

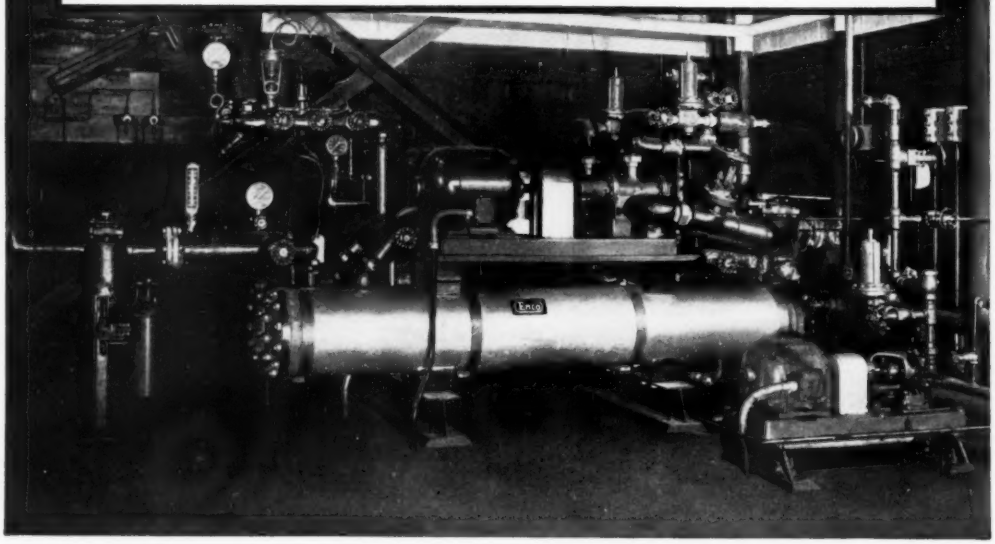
Yes! THE CHANCES ARE that a Johnson engineer from a nearby branch office has the answer to complex temperature control problems such as those encountered at 525 William Penn Place. He is equally conversant with smaller problems, too. A talk with him entails no obligation. Ask him to call on you, any time. JOHNSON SERVICE COMPANY, Milwaukee 2, Wisconsin. Direct Branch Offices in Principal Cities.



JOHNSON *Automatic Temperature and Air Conditioning* **CONTROL**

MANUFACTURE • APPLICATION • INSTALLATION • SINCE 1885

2 separate ENCO Fuel Oil Units Meet Plant Needs



Here is a typical Enco two-unit installation which handles fuel oil pumping and heating requirements in the plant of a building materials manufacturer.

Fuel Oil Pumping and Heating Unit, built with two pumps and two heaters, is designed for continuous plant load service. Capacity is 11 gpm Bunker C fuel oil with one pump or one heater at 300 psig pressure with a temperature rise from 90F to 230F.

Light Oil Pumping Unit for cold start-up service. Capacity is 3 gpm #2 oil at 300 psig pressure.

Enco pump sets are designed to give you easier control and longer maintenance-free operation. They are simple and economical to install. All you need do is to connect to station piping and run. Before shipping, every Enco Fuel Oil Pumping and Heating Unit is completely tested under high pressures. For complete details on wide-range line, write for Bulletin O B-37.

Only ENCO offers all ten plus features

1. Completely Automatic Operation is assured by automatic temperature and pressure regulation valves.

2. Coordinated Design Saves Space. All equipment essential to the preparation of fuel oil for combustion is contained in one compact unit.

3. Individually Designed to meet the specific needs of the particular power plant in accordance with its exact operating requirements.

4. All Parts Visible and Accessible for easy operation, maintenance and repair.

5. Pumps and Heaters are interconnected to provide maximum flexibility of operation.

6. Safety Valves protect individual parts where required.

7. Easier Maintenance — Less Service-Time for Cleaning because straight tube, multi-pass heaters with removable heads are used.

8. Pumps Operate at Moderate Speed. Heaters designed to give the correct viscosity and velocity without fouling.

9. Smoother Flow of Clean Fuel to Furnace. Air chamber for each piston pump prevents pulsations—pressure regulator for rotary pumps. Twin type strainers provided to keep atomizer tips from clogging.

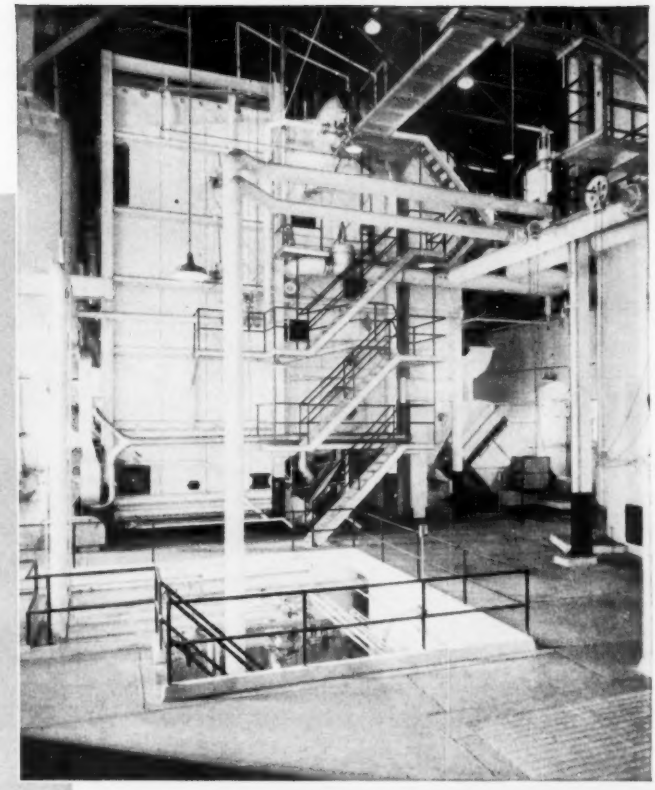
10. Cleaner Boiler Room . . . all overflows connected to a common outlet, flanged drip pan catches oil drip.

EC 485

THE ENGINEER COMPANY

75 WEST STREET, NEW YORK 6, N. Y.

IN CANADA: F. J. RASKIN, LTD., 4220 IBERVILLE ST., MONTREAL 34, P. Q.



USER*
Sugar Refinery
BOILERS
2 Erie City 2-drum
CAPACITY
150,000 lbs./hr.
DESIGN PRESSURE
450 lbs.
OPERATING PRESSURE
410 lbs.
STEAM TEMPERATURE
570°F
TEMPERATURE OF FEED-WATER
250°F
SUPERHEATERS
Erie City
AIR HEATERS
Erie City
FIRING
Traveling Grate Spreaders
FUEL
Lignite 9000 B.t.u./lb. and Bituminous 11,500 B.t.u./lb.

* Name on request

Sweet Words From Sugar Specialists

Recently an official of this large sugar refinery wrote us:

"We are all very proud of this installation and know that our boilers will meet the high standard of efficiency set by Erie City Boilers. Your personnel should be complimented for the fine workmanship that went into these boilers and the efficient manner in which our order was handled and scheduled through your shop.—This indicates good teamwork in your organization."

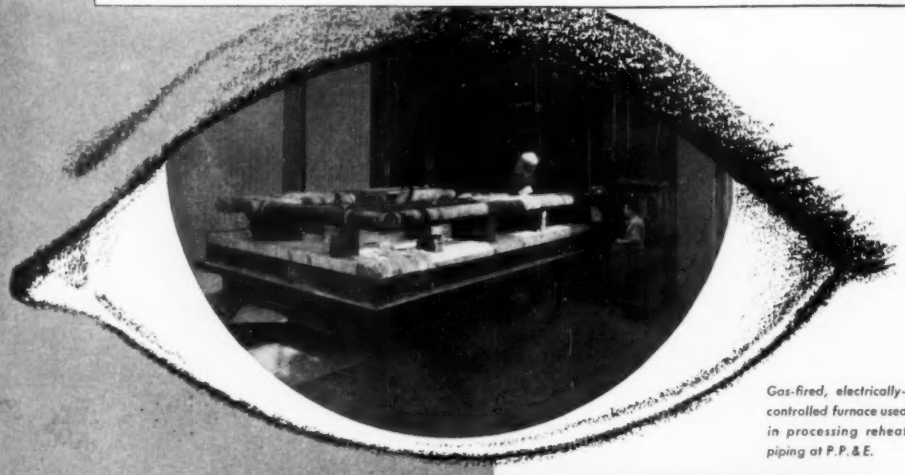
Yes, it takes good teamwork by all parties concerned to build good boilers, so whatever your steam requirement consult Erie City, for you can depend on Erie City steam generating equipment.

ERIE CITY
112 Years in Steam Generation

ERIE CITY IRON WORKS • *Erie, Pa.*

STEAM GENERATORS • SUPERHEATERS • ECONOMIZERS • AIR PREHEATERS
UNDERFEED AND SPREADER STOKERS • PULVERIZERS

Looking at REHEAT



Gas-fired, electrically-controlled furnace used in processing reheat piping at P.P.&E.

Through Experienced Eyes

Proper piping is essential in order to realize the benefits inherent in reheating steam to higher temperatures—increased volume per pound of water evaporated . . . reduced condensation in lines, casings, cylinders, etc. . . . improved BTU output . . . better fuel economy.

Remember when 750° F. was thought to be a high reheat temperature? Even then P.P.&E. was ahead of the needs in piping that would carry the load. As the trend toward higher temperatures continued, P.P.&E.'s experience accumulated.

That's why the conditions encountered in present-day reheat temperatures over 1000° F. are thoroughly understood by P. P. & E. engineers—and why adequate materials, design know-how, methods of treating and fabricating, and testing procedures are available.

Look to Pittsburgh Piping and Equipment Company for the experience, and the leadership in methods that assure greatest safety, highest efficiency, and longest service from high temperature, high pressure piping.

P. P. & E. Products

Carbon Steel Piping	Forged Piping Materials
Cast Iron Fittings	Headers
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Copper Piping	Stainless Steel Piping
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Expansion Bends	Welding Fittings
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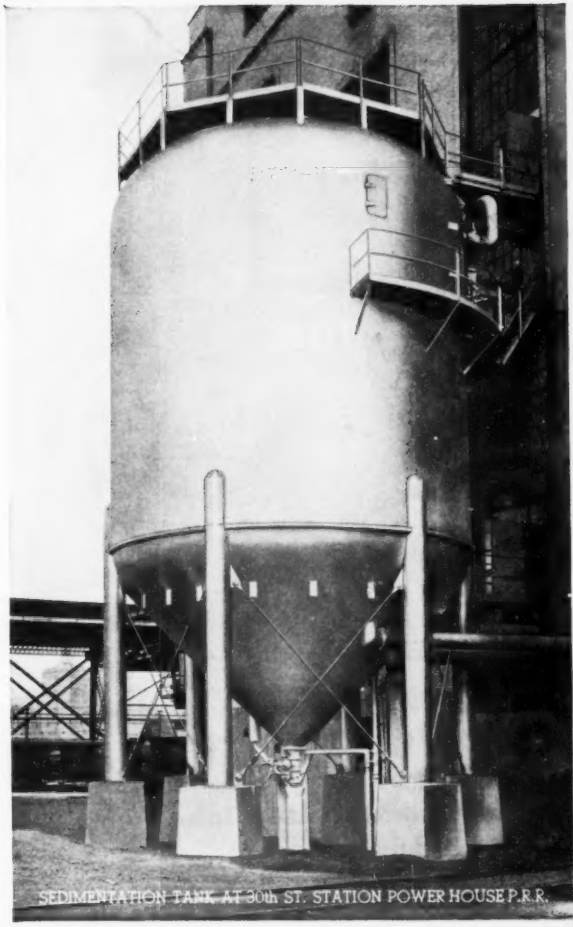


SEDIMENTATION TANK AT 30th ST. STATION POWER HOUSE P.R.R.

COCHRANE

Hot Process SOFTENER

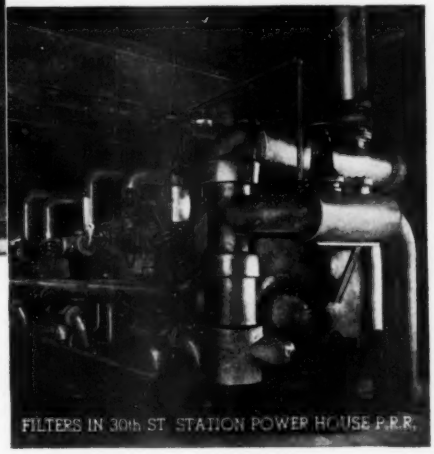
Serves a Great Railroad

ONE of the features of the huge Pennsylvania Station — 30th Street, Philadelphia, of the Pennsylvania Railroad is the ultra modern power plant, designed by internationally recognized architects and engineers.

Recently installed in this power plant to serve additional capacity is a Cochrane Hot Process Softener for the boiler feed. It will handle 80,000 gallons per hour makeup and 10,000 gallons per hour condensate.

Cochrane pioneered the development of the hot process for softening boiler feed, and has continued to lead in the field of water conditioning ever since. In recent years, Cochrane has made many installations of the new Hot Process Zeolite Softener, wherein external second stage of softening is accomplished by means of ion exchange.

Consult Cochrane on any water conditioning problem.



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COCHRANE CORPORATION

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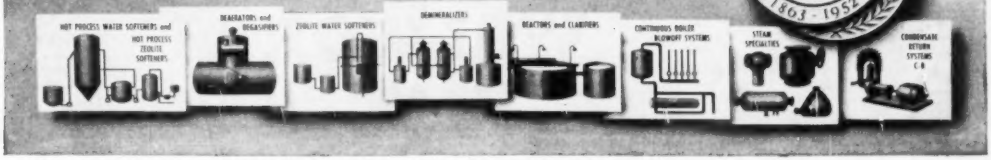
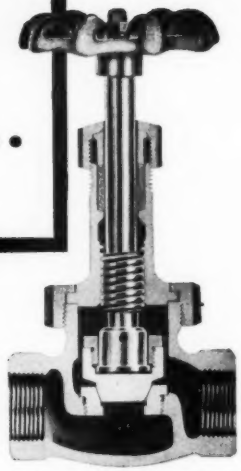
COCHRANE

COCHRANE CORPORATION 89 YEARS OF SERVICE 1863 - 1952

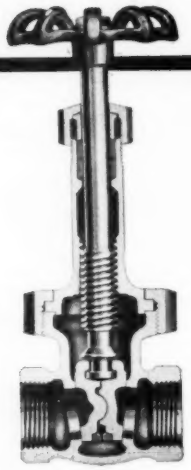
PIONEERS AND LEADERS IN BOILER FEED PROCESS & INDUSTRIAL WATER CONDITIONING



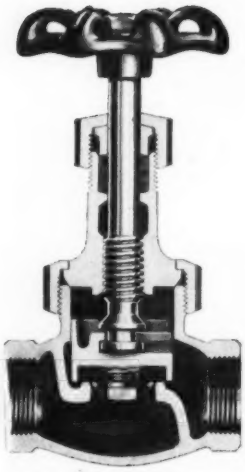
Walworth bronze valves...



Walworth No. 225P Globe Valve
500 Brinell Seat and Disc



Walworth
No. 29 Gate Valve



Walworth No. 95 Globe Valve
Re-New-Disc

built to give dependable trouble-free service on all recommended jobs

Walworth No. 95 Bronze Globe Valves (Angle Type: No. 96) are recommended for service where throttling is not required. They are rated at 150 psi working steam pressure, 500F; 300 psi cold water, oil or gas. The improved renewable disc and lock-on, slip-off disc holder — an original Walworth development—saves time and trouble. This valve can be repacked under pressure when fully opened. All parts are designed to give maximum service and strength.

Walworth No. 29 Bronze Gate Valves are rated at 200 psi working steam pressure, 550F; 400 psi cold water, oil and gas. These valves have rising stems and integral seats. Sizes 2-inch and smaller have union bonnets; sizes 2½ and 3-inch have bolted bonnets. Valves up to and including ¾-inch have solid wedge discs; 1-inch and larger have split wedge discs. These valves can be repacked under pressure when fully opened.

Walworth No. 225P Bronze Globe Valves (Angle Type: No. 227P) are rated at 350 psi working steam pressure, 550F; and 1000 psi non-shock service on cold water, oil and gas. The stainless steel, plug type seat and disc — heat treated to 500 Brinell — can be closed on sand, slag, scale and similar floatage, without injury to the seating surfaces. They are the longest wearing, TOUGHEST bronze valves you can buy.

For full information about Walworth Quality Bronze Valves, see your Walworth distributor, or write:

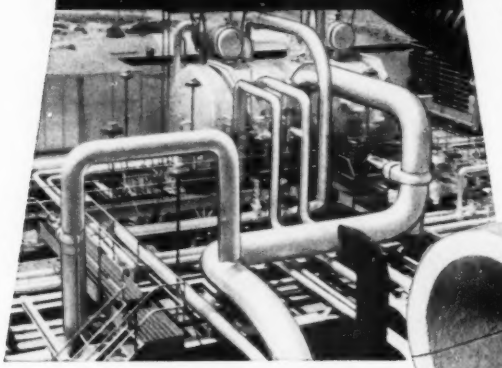
WALWORTH
valves and fittings

60 EAST 42nd STREET NEW YORK 17, N. Y.

UNIBESTOS®

KEEPS **EFFICIENCY** UP

HOLDS **MAINTENANCE** DOWN



Write for Bulletin No. 76-109, and the name of the Unarco Warehousing Distributor in your area.

Want to reduce heat-loss, surface temperature, and *maintenance costs*—all at the same time? You can, with Unibestos! And you can get stock delivery from your Unarco Distributor in cylinders, half-rounds, or blocks. When temperatures go as high as 1200° F., specify Unibestos No. 1200—and Unibestos No. 750 for up to 750° F., maximum. Or, where temperatures won't run over 600° F., ask for Unarco Amocel—it has many of the same excellent features. Unibestos and Amocel are easy to install, stay put, resist all service hazards.

UNARCO

UNION ASBESTOS & RUBBER COMPANY

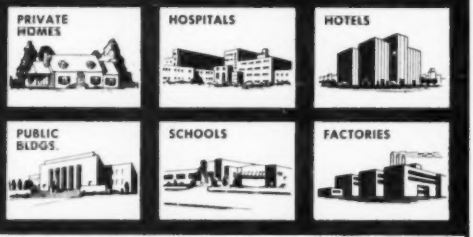
DEPT. C-5, 332 SOUTH MICHIGAN AVENUE • CHICAGO 4, ILLINOIS

THERE'S AN AUTOMATIC

JOHNSON *Oil* BURNER

Famous for high efficiency since 1903

FOR EVERY HEATING NEED!



For Steam, Hot Water, Hot Air Systems. Engineered and built to produce a maximum of usable heat from minimum fuel consumption, Johnson Oil Burners are known and respected the world over. There's a Johnson Burner dealer near you.

Johnson Oil Burners

S. T. JOHNSON CO.

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PUSH BUTTON
INSULATION RESISTANCE TESTING

with

VIBROTEST

- RANGES TO 50,000 MEGOHMS
- NO CRANKING • NO LEVELING
- ALL-ELECTRIC • RUGGED
- FULLY PORTABLE • ACCURATE

VIBROTEST is built throughout to make insulation resistance testing FAST, EASY and ACCURATE for you. No laborious cranking...No mechanical parts to get out of order...Only two binding posts for ALL tests. Several Models have A. C. and D. C. volt ranges, as well as low resistance ohmmeter.

This is an instrument that makes insulation resistance testing a "push-button" affair! Ask for more information.

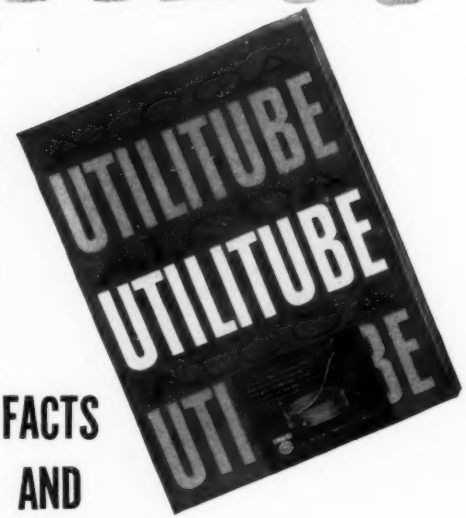
WRITE FOR BULLETIN 2-A

ASSOCIATED RESEARCH, Incorporated

"Precision Instruments Since 1930"

3770 West Belmont Avenue • Chicago 18, Illinois

NEW



FACTS AND TECHNICAL DATA ON ALCOA'S NEW, ALL-PURPOSE COILED TUBE

Send for this new booklet describing Alcoa's new aluminum coiled tube—UTILITUBE. Alcoa UTILITUBE is designed for instrumentation, fuel, air and lubrication applications. It is easier to form, flare and bend than annealed copper. It will save you up to 40% on tube costs—gives you 3 times more feet per pound. It comes in standard 50- and 100-foot lengths and in economical, long lengths up to 1,000 feet in some sizes. And aluminum fittings are now available from leading tube fitting distributors. Write:

ALUMINUM COMPANY OF AMERICA
836-E Gulf Building • Pittsburgh 19, Pennsylvania

ALCOA ALUMINUM

Masoneilan No. 11 Reducing Valve

Now Better Than Ever!

For over 65 years, these Masoneilan steam reducing valves have been the standard for service-wise users. Now new refinements make them better than ever:

More sensitive and reliable. Superfinished parts practically eliminate sticking or corrosion.

Wider range of adjustment provides a greater selection of reduced pressure settings.

Sturdier construction. Possibility of damage is minimized.

Easier to service. All parts may be removed and replaced with the valve in the line; integral pilot valve aids assembly.

And maintenance now consists of *little more than keeping the valve parts clean.*

Call or write for more details about Masoneilan Regulators —we will be glad to help you select the *best* valve for your application.

MASONEILAN
Regulators

FOR STEAM · WATER · GAS · OIL
AIR AND VACUUM CONTROL

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New Orleans • Mason-Neilan Regulator Co., Ltd., Montreal and Toronto.

87

varieties
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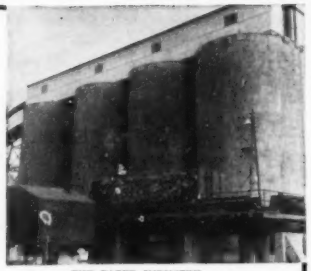


THE PAPER INDUSTRY

The photo shows four 30 x 60 ft. Neff & Fry silos used for storing wood chip at a pulp and paper plant. Each holds 30,000 cu. ft. of chips, enough to make 80 tons of pulp, which is 16% of the daily run.

Wood chips are one of the 87 kinds of flowable bulk materials handled in Neff & Fry Storage Bins. The list includes ashes, cement, clay, coal, grain, gravel, lime, nuts, ore, rock, sand, seed.

The distinctive feature of a Neff & Fry Bin is the diagonal-ended Super-Concrete Stave . . . formed under 140 tons pressure . . . . virtually as dense, strong, and enduring as natural stone. The stave does not rot, rust, burn, or spall.

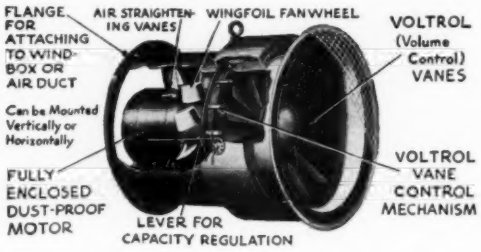
Get the whole story in our folder, "Bins With the Strength of Pillars." Ask for it now while you have the subject in mind.

Not exported except to Canada and Mexico

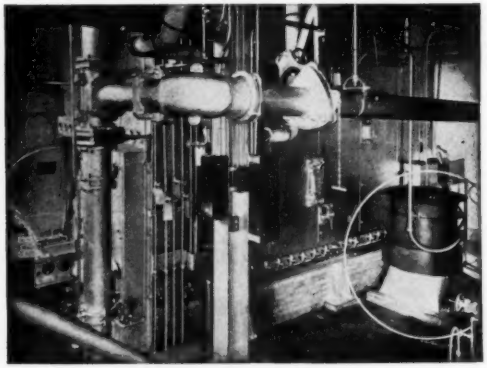
THE NEFF & FRY CO. • 270 Elm St., Camden, Ohio

SUPER-CONCRETE STAVE STORAGE BINS — NEFF & FRY

COMPACTNESS, EASE OF REGULATION, LOW MAINTENANCE—IN THE WING FORCED DRAFT BLOWER


FLANGE FOR ATTACHING TO WIND-BOX OR AIR DUCT
AIR STRAIGHTENING VANES
WINGFOIL FANWHEEL
VOLTROL (Volume Control) VANES
Can be Mounted Vertically or Horizontally
VOLTROL VANE CONTROL MECHANISM
FULLY ENCLOSED DUST-PROOF MOTOR
LEVER FOR CAPACITY REGULATION

Wing Axial Flow Blowers for over half-a-century have been delivering consistently satisfactory performance in thousands of boiler plants. Today's Wing Blowers with many superior features—such as the Voltrol Vanes for capacity regulation down to 10% at maximum—are to be found as standard equipment on many of the country's leading makes of boilers. Photo shows typical installation on an oil burner windbox. No ducts or extra supports required.



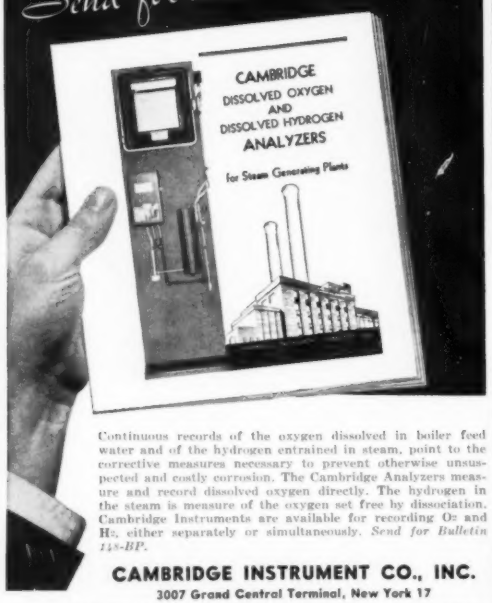
L. J. Wing Mfg. Co. 50 Vreeland Mills Rd. Linden, New Jersey

Offices in Principal Cities of U.S. & Canada

Wing

AXIAL FLOW FORCED DRAFT BLOWERS

Send for BULLETIN 148-BP



Continuous records of the oxygen dissolved in boiler feed water and of the hydrogen entrained in steam, point to the corrective measures necessary to prevent otherwise unsuspected and costly corrosion. The Cambridge Analyzers measure and record dissolved oxygen directly. The hydrogen in the steam is measure of the oxygen set free by dissociation. Cambridge Instruments are available for recording O_2 and H_2 either separately or simultaneously. *Send for Bulletin 148-BP.*

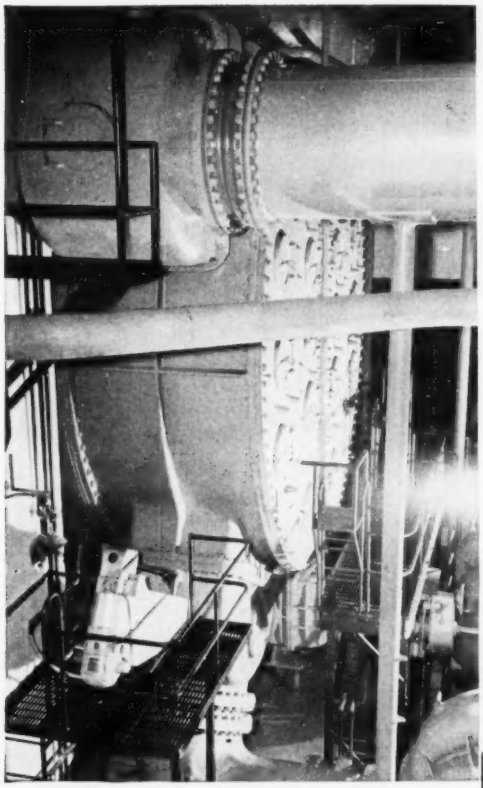
CAMBRIDGE INSTRUMENT CO., INC.

3007 Grand Central Terminal, New York 17

PIONEER MANUFACTURERS OF PRECISION INSTRUMENTS

"SELF-CLEANING" CONDENSER

Eliminates 2 to 3 HOURS Daily Down-time



At Plant Atkinson, Harryat, Georgia, the Georgia Power Company draws circulating water from the Chattahoochee River. The inevitable sand, gravel, twigs and leaves used to clog condenser tubes and tube sheets in a matter of hours. Before the installation of a C. H. Wheeler Reverse Flow "Self-Cleaning" Condenser, it was a two- to three-hour job every day to remove anywhere from ½ to 2 yards of debris by hand. During this time, it was necessary to drop the load on the turbine to about half in order to operate against excessive back pressure.

Since September 5, 1949, when a C. H. Wheeler "Self-Cleaning" Condenser was installed, there hasn't been a single shut-down for cleaning. The Reverse Flow mechanism works flawlessly 24 hours a day, with 70,000 gallons per minute of river water passing through. The only cleaning is done by means of the electrically operated valves that reverse the flow of water through the condenser, without interfering in any way with plant operation. This is done as often as necessary in a matter of minutes.

Through eliminating down-time for condenser cleaning, approximately *one month* of full capacity operation is added to the service of one of the four 60,000 KW turbo-generators in this 240,000 KW plant.

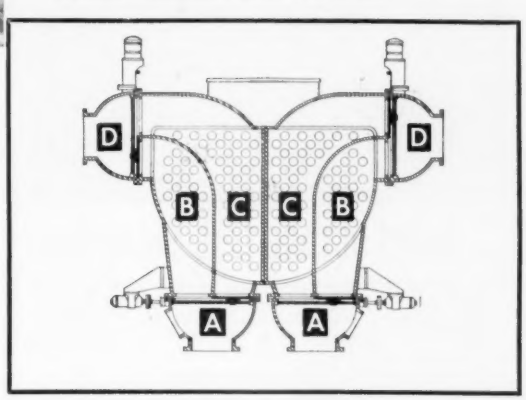
You, too, can benefit by C. H. Wheeler Engineering. Whether or not you need the self-cleaning Reverse Flow feature, it will pay you to "Investigate C. H. Wheeler Condensers before you Invest."

HERE'S HOW THE "REVERSE FLOW" PRINCIPLE WORKS ⟶

Both halves of this Dual Bank Condenser work the same but independently of each other.

Left Side: Water enters divided water box at valve chamber D, with upper port open. It flows through pass C to end of condenser, back through pass B and out through left port of A.

Right Side: Flow is reversed: Valves at inlet D and discharge A are changed to permit water to flow through B and back through C in the opposite direction, then out through lower port of A.



C. H. Wheeler OF PHILADELPHIA

STEAM CONDENSERS—STEAM JET EJECTORS—COOLING TOWERS—VACUUM REFRIGERATION—HIGH VACUUM PROCESS EQUIPMENT—MICRO-PARTICLE REDUCTION MILLS—MARINE CONDENSERS & EJECTORS—DECK MACHINERY

C. H. WHEELER MANUFACTURING CO. [illegible] PHILADELPHIA 32, PA.

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MECHANICAL PACKINGS
FOR ALL POWER APPLICATIONS

GASKETS & PUMP PACKING
of all descriptions

HOSE
of all types—fire, water, suction and discharge; explosion-proof steam hose

COMPREHENSIVE STOCKS
PROMPT DELIVERIES
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Depend on DARCOID to DELIVER!

"GUNITING" with *Super* ADACHROME-CAST

...SAVES OUTAGE TIME and MONEY

Use SUPER ADACHROME-CAST to gunite your stud tube water walls.—Fine-grained to penetrate the small apertures between studs.—packs to a dense mass when shot. One user reports SUPER ADACHROME-CAST lasted twice as long and took but one-third the time to apply as compared with a plastic chrome ore installation.

Excellent for coating brickwork when free of slag.

BOTFIELD

Yours, *FREE* for the asking . . . an illustrated, detailed Bulletin on *Super* ADACHROME-CAST.

REFRACTORIES CO.
784 S. Swanson St., Philadelphia 47, Pa.
In Canada, Canadian Botfield Refractories Co., Ltd., 171 Eastern Avenue, Toronto.

Metallic lead, aluminum, and a straight oil vehicle are combined in this Valdura paint product to provide a heavy duty maintenance paint with special emphasis on "heavy duty." Laboratory tests are now supported by field tests which prove the remarkable resistance and extremely long life of this specialized maintenance product.

Write to the address below for specific performance data on this product and for further information on the Valdura line of heavy duty maintenance paints.

VALDURA
PAINTS THAT ENDURE

VALDURA DIVISION
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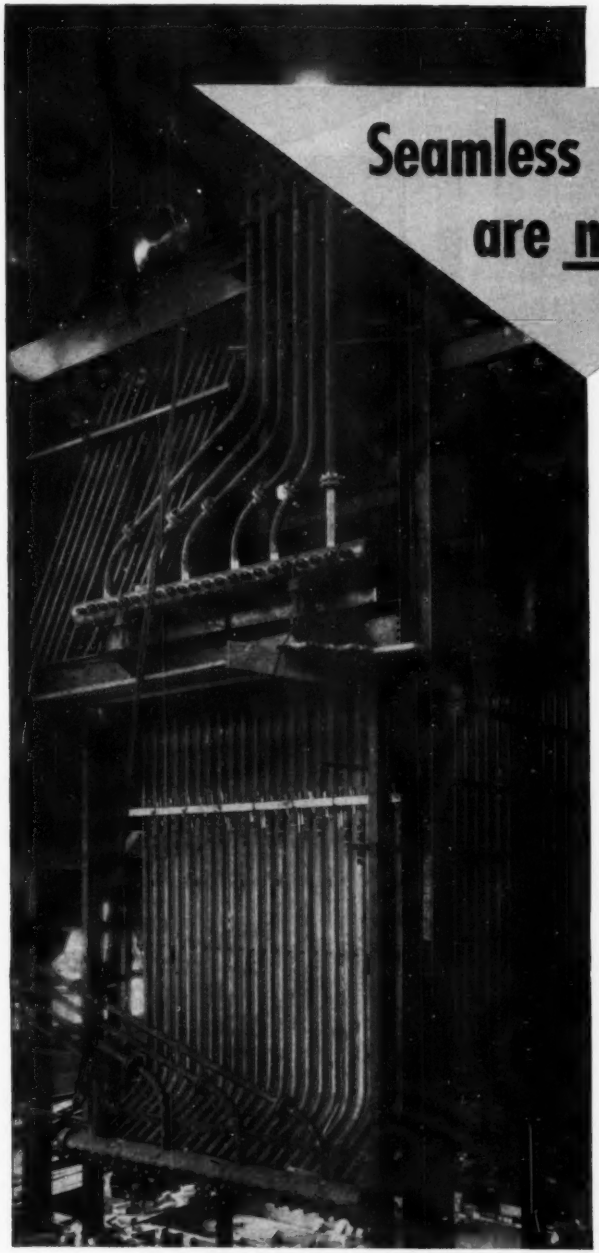

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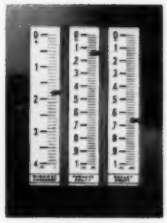

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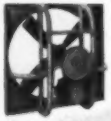

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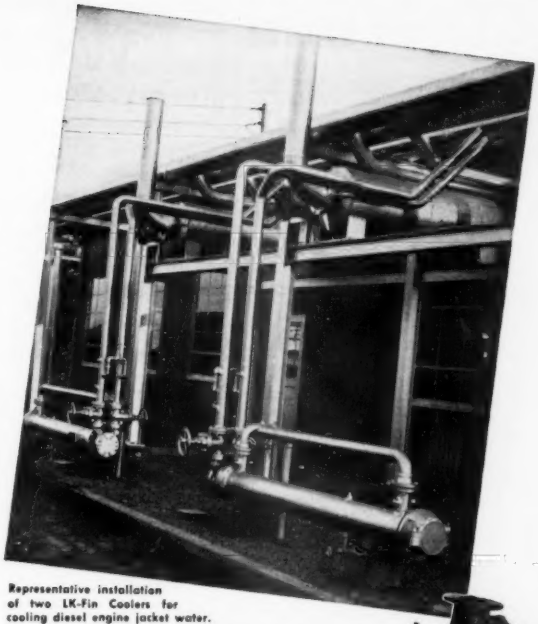
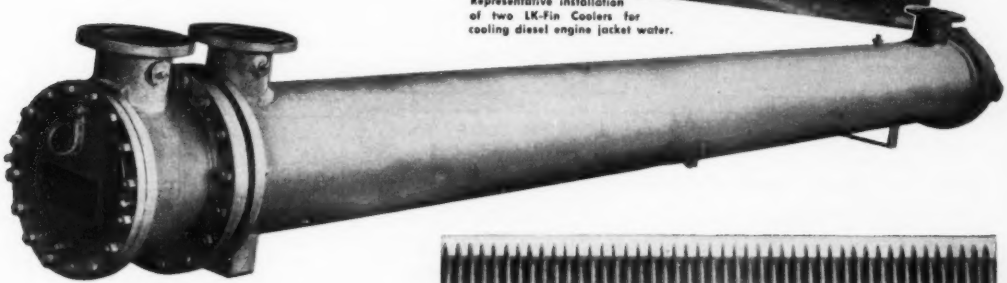
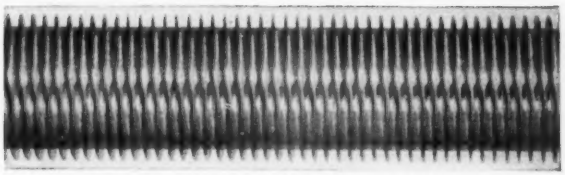


Representative installation of two LK-Fin Coolers for cooling diesel engine jacket water.



Single-pass LK-Fin Cooler viewed from stationary head end



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Some Things Are WORSE THAN STRIKES

This editorial which appears in McGraw-Hill publications was written just prior to the resignation of Charles E. Wilson as Director of Mobilization. The principle it discusses is of basic and continuing importance in our struggle to maintain economic and personal freedom in America.

It is to be hoped that the managements of the steel industry will resolutely resist the efforts of the national Wage Stabilization Board to force them to establish the union shop in their plants. In essence, the union shop means compulsory union membership.

They should resist not because of any financial advantage to the owners of the industry. There would be none. They should resist out of a decent regard for those ideals of our country which we are now fighting in Korea to protect. Moreover, their resistance would, as a matter of fact, benefit the leaders of the organized steel workers by protecting them from the certain and bitter fruits of their "victory" in getting the government to impose the union shop on the steel industry. Their successful resistance would also prevent Premier Stalin and his co-workers from enjoying a hearty laugh at our expense.

Fun for the Russians

This is why the Politburo would find the establishment of the union shop in the steel industry, at the behest of the Wage Stabilization Board, so profoundly amusing. We are fighting in Korea because we believe that armed aggression, promoted by Russia, menaces our freedom. And we are spending hundreds of billions of dollars here at home for armament to protect our freedom at other danger points. When this rearmament program is threatened by a crippling strike, the federal government through its Wage Stabilization Board proposes to buy off the threat by plowing under a vital element of that freedom which we are trying so desperately to preserve.

When the union shop is adopted through voluntary agreement, as it has been in cases covering millions of workers, it deeply undercuts the freedom of the individual. To hold his job he is required to join the union and support it financially whether he wants to or not. In the case of such voluntary agreement, however, the government takes no direct part in thus destroying the freedom of its citizens. It is essentially a private transaction.

Tyranny is the Word

But in the steel case the federal government becomes a party to a direct attempt to impose the union shop. Instead of protecting its citizens in their right to earn a livelihood, the government forces certain of them to join and support a private organization which they have clearly indicated they do not want to join. This they must do to hold their jobs. Tyranny is the accepted designation of government coercion of this kind.

It may be objected that the Wage Stabilization Board merely recommends the union shop, does not order it. This was also true of the action recently taken by a President's Emergency Board, which also "recommended" that working agreements between the

railroads and about a million non-operating railroad employees include a provision for the union shop. A government recommendation, however, can easily be given much of the force of an order, particularly by the calling of a strike to "uphold the hand of the government."

It seems entirely clear that in trying to impose the union shop on the steel industry the Wage Stabilization Board has completely lost its bearings. It was set up to handle labor problems to tide over an emergency. Now it comes up with a revolutionary modification of labor relations in the steel industry which, if adopted, would become a permanent part of the institutional machinery of the industry.

"Too Much Like Hitler"

Early in World War II an effort was made to have the federal government order the union shop for a group of organized coal miners. President Franklin D. Roosevelt, who will go down in history as one of organized labor's greatest champions, blocked it. "That," he said, "would be too much like the Hitler methods toward labor." But now, with supreme irony, the federal government fosters this Hitlerlike method toward labor ostensibly to advance our conflict with Stalin.

In persuading the Wage Stabilization Board to sponsor the union shop for steel workers, there is every reason to believe that the union leaders have trapped themselves. If the government imposes the union shop, a next step clearly becomes necessary. This is government regulation of the union in order to provide a modicum of protection for the minority that would be forced by the government to join against their will. It could be that for a time the government would ignore this obligation. But, having granted the union the power to eliminate the minority, it would sooner or later be forced to regulate the use of that power. Thus free collective bargaining and freedom itself would be the losers.

An Issue of Basic Principle

Resistance to a government-sponsored union shop for the steel industry is bound to bring harsh denunciation both from the administration and union leaders who have teamed to back it. Not only does the union shop relieve the union leaders of the problem of recruiting members, it also eliminates a group of workers that they stigmatize as "free riders"—namely, those who work for companies which have a working agreement with a union but do not join the union. In the basic steel industry about 10 per cent of those who work for companies with union agreements are not members of the union. Such a small percentage of non-members is obviously no threat to the "security" of the union, although that is what the drive for the union shop ostensibly is designed to protect.

In the reporting of the present labor dispute in the steel industry virtually all of the attention has been focussed on the handling of the issue of a wage increase and how large it should be. This, to be sure, is vitally important. Mobilization Director Wilson has said it is "a serious threat to our year-old effort to stabilize the economy." But certainly of comparable importance is the tremendous issue of principle raised by the government's backing of the union shop for the steel industry.

If the position of the Wage Stabilization Board on the union shop prevails, our government will have blunted the arms we are forging to fight for our freedom abroad by undermining a major bulwark of our freedom right here at home. At this critical time in the struggle to preserve and protect our freedom such a subversive course should be resisted to the limit.

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1		1500	1200	60
1		1420	514	60
3		1250	720	60
1		1250	1200	60
1		1000	750	25
2		1000	600	60
1		1000	720	60
1		800	900	60
1		720	900	60
2		650	139	60
1		500	720	60
1		412	225	60
1		400	450	60
1		400	250	25
1		375	750	25
2		375	1200	60
1		350	720	60
1		312	1200	60
1		300	750	25
1		300	180	60
1		280	1200	60

Plus 78 smaller units from 3 KVA to 250 KVA

DC—ADJ. SPEED—230 V.

Quan.	HP	Make	Speed
1	650	G. E.	750/2000
1	300	G. E.	400/ 800
1	250	West.	250/ 675
4	250	West.	540/3000
1	125/190	G. E.	260/ 400
1	150	West.	320/ 580
1	150	Rel.	400/1200
1	100/150	West.	500/ 750
2	100	Rel.	575/1150
2	100	West.	450/1000
1	100	G.E.	1050/4000
1	60	El. Dyn.	525/1050
2	30/71	West.	550/ 750
1	50/60	G. E.	220/1000
2	50	Diehl	400/ 800
1	25/50	G. E.	300/1200
1	35	G. E.	250/1000
1	30	West.	500/1000
1	30	West.	700/1750
1	30	Rel. TEFC	400/1200
2	25/30	Cr. Wh. TEFC	500/1500
3	25	G. E.	500/1500

Plus 327 smaller units 1 HP to 25 HP

SLIP RING MOTORS

Quan.	HP	Speed	Make
1	600	1800	G. E.
1	500	1800	G. E.
1	400	514	G. E.
1	400	435	West.
1	300	500	G. E.
1	300	450	G. E.
2	250	600	G. E.
1	250	480	G. E.
2	200	600	G. E.
3	200	450	Burke
1	150	450	G. E.
1	125	435	G.E.
6	100	450	G.E.
1	100	900	G.E.
1	75	1200	G.E.
1	75	900	Al. Ch.

Plus 837 smaller units 1 HP to 75 HP

ROTARY CONVERTORS

Quan.	KW	Make	Speed	Volts
3	500	G. E.	1200	250
3	400	West.	1200	250
1	300	West.	1200	250

P.S.—We Stock Explosion-Proof Motors—Class 1-D & 2-G

CONSTANT SPEED—230 V.

HP or KW	Make	Speed
1500 KW	West. 125/250 V.	514
500 KW (2)	West. 125/250 V.	514
400 HP	El. Dyn.	1500
400 HP	G. E.	450
350 KW	G.E. 180 V.	1300
300 KW	G. E. 170 V.	1200
250 KW	Al. Ch.	750
150 KW	West. 125/250 V.	750
150 KW	G. E.	1200
150 HP	West.	1615/1785
125 HP	Star	1200

Plus 675 smaller units 1 HP to 120 HP also 115 V. & 550 V. DC.

Note: We Stock 6000 New Motors, Controls, Frequency Changers
SEND US YOUR INQUIRIES!

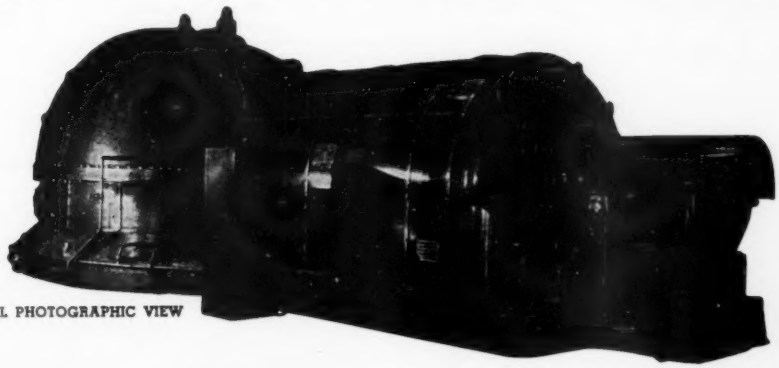
ELECTRIC EQUIPMENT COMPANY

PHONE LD65

New and Rebuilt — ROCHESTER, N. Y. — 1 H. P. to 2500 H. P.

MOTORS · MG SETS · TRANSFORMERS · CONTROLS · COMPRESSORS

25,000 KVA—20,000 KW, 80% P.F., 3 phase 60 cycle, 13,200 volts, 1800 RPM General Electric Company condensing turbine generator unit 215 P.S.I.G. 540-550° T.T. complete with direct connected shaft exciter, switchboard, a 30,000 square foot Westinghouse surface condenser and condensing accessories, including 2—150,000 pounds steam per hour B&W sectional header cross drum boilers, 250# pres., 550° T.T. equipped with Taylor retort stokers.



ACTUAL PHOTOGRAPHIC VIEW

EXCELLENT CONDITION — COMPLETE INSTALLATION — PROMPT DELIVERY

TURBINE-GENERATOR UNITS

Condensing—3 phase, 60 cycle

1250 KVA G.E., 5-stage, 2300/4160 volts, 200# P.S.I., 600° TT.
3750 KVA Westghse. 2300 volt, 200 PSI.
2500 KVA G.E. Type ATB, Form HT, 2300/480 volts, 3600 RPM, 2-bearing alternating current generator LESS TURBINE.
2500 KVA Westghse. 2300 volt, 250 PSI.
1563 KVA Allis, 600 volts, 200 PSI.
1250 KVA G.E. AUTOMATIC EXTRACTION BLEEDER 2300 volts, 250 PSI.
937 KVA Allis, 480 volts, 250 PSI.
780 KVA Allis, 480 volts, 150 PSI.
625 KVA G.E. 480 volts, 150 PSI.

Non-condensing—3 phase, 60 cycle

1563 KVA G.E. 600 volt, 250 PSI, 20# gauge back.
940 KVA Allis 2300/480 volts, 125-150 PSI 12# back.
625 KVA G.E. 480 volts, 125-150 PSI, 20# back.
375 KVA Westghse-Moore 480 volts, 250 PSI 5-10# back.
125 KVA G.E., 2300 volts, 150-200 PSI.
125 KVA Westghse. 2400 volts, 150-250 PSI 10# back.

Direct Current

1000 KW G.E., 250 volt, 150 PSI, automatic extraction, condensing.
500 KW G.E., 250 volt, 200 P.S.I., 25# gauge back non-condensing.
300 KW Westghse. 3-wire, 250 volt 150/250# P.S.I. non-condensing.
100 KW (2) G.E., 125 volts, 200-275 PSI.
75 KW (2) Westinghouse-Moore, 120 volt, 200# P.S.I. condensing.

Direct Current (Cont.)

60 KW (2) Elliott, 125 volt, 200-250 P.S.I. non-condensing.

MOTOR GENERATOR SETS

100 KVA Westghse. 60 cycle, 2400 volts, alternator connected 135 HP, 250 volt direct current motor.
62½ KVA G.E., 60 cycle, 2300 volt alternator to 75 HP, 125 volt DC motor.
50 KW G.E. 125 volt direct current 1200 RPM to a 3 phase, 60 cycle, 220 volt syn. motor.
10 KW G.E., 125 volt direct current to a 3 phase, 60 cycle, 220 volt motor.

May BARGAINS
SPECIALLY PRICED

1000 KVA, 60 cycle, 2300/4000 volt, 600 RPM, Westghse. alternator with complete base for direct connection to Diesel engine.
2—225 HP, 400 RPM Buckeye Diesel engines each connected 1875 KVA, 60 cycle 240 volt Electric Machinery generators.
547 HP, 250# pres. and three 400 HP, 225# pres. B&W water tube boilers.
8000 sq. ft. Wheeler, 4400 sq ft. Worthington, 2000 sq. ft. Worthington and one 1500 sq. ft. Westinghouse surface condensers.
4900 GPM and 3500 GPM Allis 2-stage pumps, 130 ft. hd. each direct connected 400-325 HP Allis 3 phase, 60 cycle, 2300 volt motor.
2—1000 GPM, 1270 foot head, 4-stage Morris pumps each connected 417 HP, 390# P.S.I., G.E. turbine.
25 HP G.E. 60 cycle, 220 volt, 1170 RPM T.E.F.C. motor.

SYNCHRONOUS MOTORS

3 phase, 60 cycle

5000 KVA Westinghouse, 4000 volt, 720 RPM Electrical Syn. (condenser).
600 HP G.E., 2300 volt, 240 RPM.

UNAFLOW GENERATOR UNITS

3 Phase, 60 Cycle

750 KVA Westghse., 460 volt generator connected Skinner horizontal engine, 150 PSI, complete.
625 KVA G.E. 240 volt generator connected 29"x36" Skinner horizontal engine, 150 PSI complete.
575 KVA Westghse., 2400 volt generator connected Ames vertical engine, 150 PSI.
500 KVA G.E. 240 volt generator connected Skinner Vertical engine 150-175 PSI complete.
175 KVA Westghse., 240 volt generator connected Skinner Horizontal Engine, 125-150# P.S.I., 5# gauge back.

Direct Current

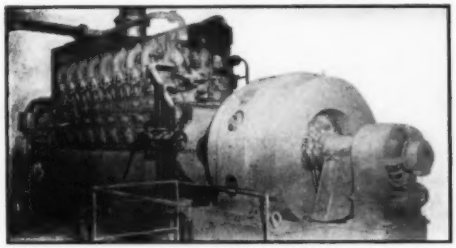
400 KW G.E., 3-wire, 250 volts, 360 RPM generator connected Skinner vertical engine 150 PSI—5# back.
250 KW Crocker Wheeler 125 volt generator direct connected Ames Vertical non-condensing engine 150#.
20 KW Allis 125 volt generator connected Hill vertical Diesel engine.

UMC UTILITIES MACHINERY CORP.
1965 EAST 6th STREET • CLEVELAND 14, OHIO • Long Distance 422

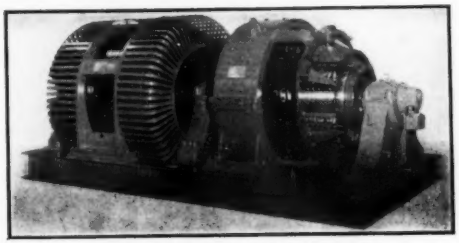
"THE O'BRIEN STORY"

AVAILABILITY . . . SPEED . . . SERVICE . . . ECONOMY . . . these are the facets for which the O'Brien name is famous in the Machinery Industry. These are the factors behind which The O'Brien Machinery Company has built their business and reputation over the past 37 years, and these are the reasons, so vital to National Production today, that O'Brien is called upon to supply the Nation's leading Industrial firms with Power Plant and Metal Working Machinery of all types. National production and Defense requirements in today's world demand speed and that's why one source of supply for your Industrial Machinery is of prime importance to you. Splitting the responsibility for furnishing plant equipment wastes time, trouble and transportation. Why do it when time is so precious, dependability and delivery so vital to your production. From one source you can secure all your requirements, not only for Power Plant equipment, but also for Metal Working Machinery of all types. Place your complete order with . . . *O'BRIEN* . . . your responsible source of supply . . . and be absolutely assured of . . . Availability . . . Speed . . . Service and Economy.

Read more about "The O'Brien Story" in the next issue of Power



1250 KVA GM DIESEL GENERATOR SET



500 KW WEST. MOTOR GENERATOR SET

MOTOR GENERATOR SETS

1—1500 KW GE MPC 300 V 5000 Amp.—2150 HP ATI-Syn Motor, 3/60/4000 Volt. Available immediately.
1—1000 K.W. West. 250 volt Flat Compound 500 RPM 1440 H.P. West. Syn. Mtr. .8 P.F. 3/25 cycle 2300 V. A.C. & D.C. Panels.
1—660 KW G.E. MPC—2400 amp. 230 volt 514 RPM with 1050 H.P. G.E.—ATI Syn. Motor .8 P.F. 2 ph., 60 cy., 2300 V. A.C. & D.C. Panels. Can furnish 3 ph. 550 V. or 2300 V.
1—500 KW Westinghouse 250 Volt 900 RPM with 720 H.P. West. Syn. Motors 3/60/6600/13200 volt, Serial #813047 (year 1935) See actual photo above.
1—500 K.W. Crocker Wheeler CCD, 250 volt 720 RPM with 750 KVA Cr. Wh. Syn. Motor 3/6/2300 V. A.C. & D.C. Panels.
1—400 KW West. 500 Volt D.C. Any A.C. Voltage with 500 HP West. 350 RPM, 500 Volt Motor for complete drive.
1—360 KW GE CY 125, 180 V., Sep. Exc., 1200 RPM. 500 HP Syn. Mtr., 3/60/2300, 1942.
1—300 K.W. West. 3 wire 125/250 Volt 1200 RPM Generator (1938 year). Can furnish with suitable motor. Advise Requirement.
1—300 K.W. Elliott 250 Volt 1200 RPM with 500 H.P. Syn. Motor 3/60/2300/1200 RPM —Automatic Controller & D.C. Panel.
2—150 K.W. G.E. Type MPC—250 Volt 1200 RPM 3/60/2300/200 H.P. Syn. Motor Drive A.C. & D.C. Panels.
1—100 K.W. Al. Ch., 250 V. 1200 RPM 150 H.P. Syn. Mtr. 2/60 or 3/60 any voltage.
1—100 K.W. G.E.—C.D.—125 Volt D.C. 150 H.P. GE Syn. Mtr., 3/60/220/440/1200 RPM.
1—75 K.W. Burke 250 V., 900 RPM 113 H.P. Burke—Syn. M.D. 2 or 3 ph. any voltage.
2—50 KW GE 500 Volt DC, 75 HP, 3/60/440/1200 RPM.
Smaller Sizes and Types—Advise Requirements

CENTRIFUGAL PUMP

Qu.	GPM	TNH	Descr.	Size	HP	Speed
1	8,000	110′	Worthington	14″	300	1200
1	6,000	110′	Ingersoll-Rand	12″	200	1200
1	4,000	110′	Ingersoll-Rand	12″	200	1200
1	3,500	47′	Southwalk	12″	100	870
2	1,700	95′	De Laval	10″	60	1750
1	1,500	231′	Allis-Chalmers	8″	150	1750
1	1,200	40′	Worthington	6″	15	1750

DIESEL & GASOLINE GENERATOR SETS

2—1250 K.V.A. GM 16 Cyl. 3/60/2300 New 1946 Comp. Plant. (See Photo Above)
1—937 K.V.A. GM 12 Cyl. New Engine. Rebuilt Gen. 3/60/480 or 2300.
1—625 K.V.A. Baldwin Series 600—New 1948 —1500 hours. 3/60/2300/514 RPM.
2—438 K.V.A. GM—West. 3/60/2200 360 RPM —New 1937. Complete Plant.
2—375 K.V.A. GM 8-268A, 3/60/480/1200 RPM.
1—300 K.W. GM New 8-268A, 230 DC.
1—250 K.V.A. GM Twin 6-71, 3/60/220/440.
1—125 K.V.A. GM New Twin 4-71, 3/60/220.
1—125 K.V.A. Hercules, 3/60/220/440/1500 Hrs
1—62.5 K.V.A. Cummins 6 Cyl. 3/60/220/440.
1—56 K.V.A. Climax Gasoline. 3/60/220/1200.
2—45 K.V.A. Chry. New 6 Cyl. 3/60/220/440.

ELECTRIC MOTORS

Qu.	HP	Make	Type	Volts	Speed
2	500	West.	CS	6600	514
1	400	G.E.	Syn.	2300	450
1	350	G.E.	MT18	2300	400
1	315	G.E.	Syn.	2200	720
1	200	West.	Syn.	2300	1200
1	150	Ideal	Syn.	220	1200
1	125	West.	Syn. (3 brg.)	550	600
1	125	Cent.	SC	440	1800
2	100	G.E.	Syn.	440	300
1	75	West.	CW	440	1200
1	50	West.	CS	440	3600

TURBO GENERATORS

1—780 KVA G.E.-Moore 3/60/2300/3600 RPM Non-Cond. 180 PSI 35 lb. B.P. New 1936.
1—500 KVA West. Non-Cond. 3/60/220/440, 150 PSI 10 lb. B.P.
2—375 KVA West. Non-Cond. 3/60/440 125 psi 5 B.P. New 1938

TURBO GENERATORS (Con't)

1—300 KW West. 3 wire 125/250 Volt D.C., Non-Cond. Turbo Unit 125 PSI, 5 lbs. B.P. New 1938
1—75 KW G.E. Non-Cond. D.C. 125 volt.
1—35 KW G.E. Non-Cond. D.C. 125 volt.

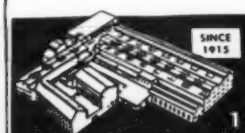
AIR COMPRESSORS

1—12,000 CFM I.R. Turbo 3.25 Lb., direct 250 H.P., 440/3/60/3600.
1—5600 CFM I.R. PRE-2, 42/25½x30, 100 lb. direct 930 HP Syn. 1 P.F. 2300/60/3.
1—4690 CFM I.R. PRE-2 48/24x27 100 lb. direct 804 HP Syn. .8 PF 2300/60/3.
1—3000 CFM GE Turbo 5 lb. direct 90 HP 440/3/60/3600.
2—1400 CFM Sullivan WJ 3 Angle Cpd. 100 psi 22/13x16 belt.
2—1200 CFM I.R. 22/13x16 100 psi belt.
1—900 CFM CP 100 lb. 9CP Portable Diesel Compressor, Pneu. tires.
1—734 CFM Sullivan W-13 13/18x8 60 lb. belt.
1—528 CFM CP NSB 14x12 100 lb.
1—371 CFM Schramm 7¼/5x4 100 lb.
1—368 CFM I.R. ER-1 12x10 100 psi.
1—350 CFM I.R. type 40 7/6¼x5 air cooled 125 lb. direct 75 HP 220/440/60/3 870.
1—396 CFM Sullivan type WL-60 100 psi.
1—215 CFM Penna. 3A 10x8 50 lb.
1—173 CFM CP NSB 9x8 100 lb.
1—173 CFM Penna. 3A 9x8 100 lb.
1—122 CFM Worthington 7x7 Horiz. 100 lb.
2—89 CFM CP 6x7 TB 150 lb.
1—40 CFM I.R. Type 30 80 lb. Tank mtd. 7½ HP
3—21 CFM Curtis CJ-1000, 3 stage 850 lb.
5—16.86 I.R. Type 30, 3½/2x5 400 lb.
100—10 CFM I.R. Type N 26 lb. or 25" Hg. Vac.

BOILERS (ASME)

2—106 H.P., Keeler, Self-contained, 125#
1—240 H.P., Keeler, Horizontal, Long-Drum, Water Tube, 200#
2—250 H.P., Bigelow, Self-contained, 125#
2—360 H.P., Springfield, Cr. Drum, Str. Tube, Sect. Hdr., Water wall 250#
1—390 H.P., Springfield, Cr. Drum, Str. Tube, Sect. Hdr. Water wall, 300#

"Everything from a Pulley to a Powerhouse"



SINCE 1915

THE O'BRIEN MACHINERY CO.

PHILADELPHIA'S LEADING MACHINERY DEALERS & EXPORTERS

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THE TRADE MARK WITH A MEANING
SUCCESSFUL OPERATION GUARANTEED
44th YEAR OF SERVICE—MEMBER OF A.R.A.*

MOTOR GENERATOR SET
3 ph. 60 Cycle

Qu.	KW	Make	Speed	D.C. Volts	A.C. Volts
2	2000*	G.E.	500	600	6600/11000
1	1500	G.E.	720	600	6600/13200
1	1500	Whse.	600	600	2300-4600
1	1500	G.E.	560	275	2200/4400
1	1500	G.E.	600	600	2300/4150
2	1000	Whse.	900	600	2300/4150
1	1000	G.E.	900	200	6600
1	1000(3U)	G.E.	900	250	2400/4800
1	500	Whse.	900	125/250	440
1	500	Whse.	900	250	6600/13200
1	500	Whse.	1200	125/250	2300
1	500	G.E.	720	125	2300/4000
1	400	G.E.	720	250	440/2300
1	400	Whse.	1200	250	2300
1	375	G.E.	900	125	2300/4150
1	300	A.C.	1200	125/250	2300
1	150	G.E.	1200	250	2300
1	150	Whse.	1200	275	2300
1	150	G.E.	1175	125	440
1	140(3U)	Cr. Wh.	690	125/250	2300
1	125	G.E.	1200	125	440
1	100	Delco	1200	125/250	440
1	75	G.E.	1200	125	4000
1	75	G.E.	1200	250	440
1	40	Whse.	1200	250	220

*25 Cycle

ROTARY CONVERTERS
60 Cycles

Qu.	KW	Make	Speed	D.C. Volts	A.C. Volts
1	2000	G.E.	514	600	13800
1	1000	Whse.	900	600	11000

TURBO GENERATORS

Qu.	KW	Make	Desc.
1	6000	Al. Ch.	Condensing 200/250 ISP 2300/3/60 Exc. & Surface Cond.
1	2500	G.E.	Auto. Ext. Cond. 800 lbs. 800* P.T.T. 175/200 Auto. Ext. 2300/3/60 Exciter & Surface Cond.
2	1000	G.E.	Non-condensing. 175/200 lbs. I.S.P. 5/20 lbs. G.B.P., 480/3/60.
1	750	G.E.	Condensing 425#-725#TT ISP-740 V. 3 ph. 60 cy. New—1941
1	500	Moore	Non-condensing — 150/200 lbs. ISP 5/35 lbs. G.B.P.—3/60.480 volts direct connected exciter
2	500	G.E.	Non-condensing 175/200 lbs. I.S.P., 5/30 G.B.P., 480/3/60
1	400	Whse.	Non-condensing 125/150# ISP 5/10.2 G.B.P., 240/480v. 3 ph. 60 cy.
1	300	G.E.	Non-condensing 150/175# ISP 5/15# B.P. 180V. 3 ph. 60 cy.
1	200	Whse.	Non-condensing 150# ISP 7# B.P. 240 V. 3 ph. 60 cy.

400 KW MADE UP MG SET
CAN MAKE UP SIMILAR SET

D. C. MOTORS

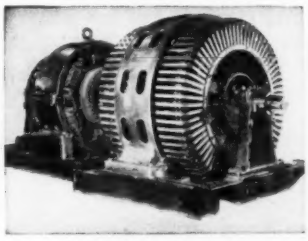
Qu.	HP	Make	Type	Volts	Speed
1—	2200	G.E.	MCF	600	360/500
1—	1750	West.		600	525/720
1—	1500	Whse.		525	600
1—	940	Whse.	QM-R Brg.	250	140-170
1—	800/1000	Whse.		450	600-720
1—	600	AL Ch.	MILL	230	480-800
1—	500	Whse.	Mill	600	300-900
2—	450	Whse.		550	415
1—	400	G.E.	MCF	550	360/1050
1—	300/400	G.E.	DYNA	250	1325/2500
1—	350	Cr. Wh.	CCM-151H	230	1100
1—	335	Whse.	MQ	250	300/900
1—	200/300	G.E.	MPC	230	360/920
1—	250	G.E.	MPC	230	500/500
1—	150	G.E.		600	250/750
10—	150	Cr. Wh.	83H	230	890
1—	150	Cr. Wh.	CMC-65H	230	1150
1—	150	Whse.	SK-201	230	360/950
1—	50-120	G.E.	MFC	230	250-1000
2—	100	Whse.	SK-181	230	150-1000

FREQUENCY CHANGERS

Qu.	KW	Make	Cycles	Voltage
1—	3000	G.E.	25/60	4000-2300x2300-4000
1—	2000	G.E.	25-62½	2300/4160
1—	2000	Whse.	25-62½	2300/2300
1—	1000	G.E.	25/58	4400/2300
1—	500	A.C.	25/60	11000/2300V

SYNCHRONOUS CONDENSERS

Qu.	Kva	Make	Volts	Speed
1	5000	Whse.	2400/1800	600



500 KW MG SET
IN STOCK

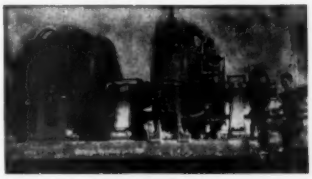
TRANSFORMERS
60 Cycles

Qu.	KVA	Make	Type	Ph.	Voltages
3	1250	G.E.	HT	3	13200x440-2300
1	1200	A.B.B.	OISC	3	13800/6900x480
3	1000	G.E.	H	1	2300x480
3	1000	Pitts.	OISC	1	22000x13200/2200
3	1250	G.E.	H	1	6600x550
1	1150	A.C.	OISC	3	13200x2300/480
1	900	G.E.	HTH	3	2400x240/480
3	500	Al. Ch.	OISC	1	1180x6600
1	500	Whse.	OISC	1	34650x432
1	500	Whse.	OISC	3	13400x216
9	500	G.E.	HT	3	2400x240/480
3	150	Whse.	OISC	1	34500x230/460
3	100	G.E.	OISC	1	2400x120/240

RECTIFIERS

Qu.	KW	Make	Type	Volts	Speed
1—	750	G.E.	BHW	575	2300
1—	1000	A.C.	B-612	625	13500
1—1000*		A.B.B.	GRZ	625	6600/13200

*This unit with full automatic control good for both 25 and 60 cycle.



2000 KW—MG SET
IN STOCK

A. C. MOTORS
3 ph. 60 Cycle
SYNCHRONOUS

HP	Make	Type	Volts	Speed
2—3500	G.E.	TS	2300	257
1—2500	Whse.		2300	720
2—2100	G.E.	ATI	2300	360
2—2000	Whse.		2300	120
2—1750	G.E.	ATI	2300	3600
3—735	G.E.	ATI	2200/12000	600
1—500	G.E.	TS 7657	2400/4800	600
1—450	Whse.	Eng.	2200	128.5
1—450	Whse.		2300	450
2—350	G.E.	TS	2200	150
1—200	Whse.		2300	720
1—100	Whse.		550	600
1—100	F.M.		220	1200
1—100	E.M.		440	600
1—	85	G.E.	440	1800

SLIP RING

1—	500	Whse.	CW	550
2—	500	G.E. unused	M-574Y	2200
1—	500	G.E.	IP	550
1—	500	G.E.	IM	440
1—	250	G.E.	MT442-Y	2300/4000
1—	300	Al. Ch.	2 Brg.	2300
4—	300	G.E.	ITC-5017	550
1—	300	Al. Chal.	ANY	2200
1—	250	G.E.	MT-424Y	4000
1—	250	G.E.	MT-559S	2200
1—	250	A.C.		550
1—	200	Cr. Wh.	20QB	440
1—	200	G.E.	IM	440
1—	200	G.E.	MTP	440
3—	200	G.E.	IM-17	440
1—	150 new	Whse.	CW	2300
4—	125	G.E.	MT-566Y	440/2200
1—	100	G.E.	IM-16	2200
2—	100	G.E.	IM	440
3—	100	Al. Ch.	ANY	440
1—	100	G.E.	MT556	2200
1—	75	Whse.	CW-761	2200

SQUIRREL CAGE

2—	450	G.E.	FT559BY	440
2—	450	Whse.	CS	2300/4150
1—	300	G.E.	KT-574Y	2300
1—	200	G.E.	IK-17	440
1—	200	G.E.	KT557	440
1—	200	G.E.	IK	440
1—	150	Whse.	CS	440
1—	150	Wstghse.	CS8568	440
1—	125	Whse.	MS	440
1—	125	G.E.	KF-TEFC	440
2—	125	Al. Ch.	ARW	2200
1—	100	G.E.	IK-Vert.	2300
1—	100	G.E.	KT-513	220/440

3500	G.E.	TS	257
2500	Whse.		720
2100	G.E.	ATI	360
2000	Whse.		120
1750	G.E.	ATI	3600
735	G.E.	ATI	600
500	G.E.	TS 7657	600
450	Whse.	Eng.	128.5
450	Whse.		450
350	G.E.	TS	150
200	Whse.		720
100	Whse.		600
100	F.M.		1200
100	E.M.		600
85	G.E.	TS	1800

500	Whse.	CW	550	550
500	G.E. unused	M-574Y	2200	900
500	G.E.	IP	550	505
500	G.E.	IM	440	900
250	G.E.	MT442-Y	2300/4000	253
300	Al. Ch.	2 Brg.	2300	505
300	G.E.	ITC-5017	550	585
300	Al. Chal.	ANY	2200	708
250	G.E.	MT-424Y	4000	257
250	G.E.	MT-559S	2200	1750
250	A.C.		550	600
200	Cr. Wh.	20QB	440	585
200	G.E.	IM	440	435
200	G.E.	MTP	440	1170
200	G.E.	IM-17	440	580
150 new	Whse.	CW	2300	450
125	G.E.	MT-566Y	440/2200	435
100	G.E.	IM-16	2200	435
100	G.E.	IM	440	600
100	Al. Ch.	ANY	440	695
100	G.E.	MT556	2200	900
75	Whse.	CW-761	2200	1725

450	G.E.	FT559BY	440	3750
450	Whse.	CS	2300/4150	354
300	G.E.	KT-574Y	2300	585
200	G.E.	IK-17	440	580
200	G.E.	KT557	440	1800
200	G.E.	IK	440	865
150	Whse.	CS	440	580
150	Wstghse.	CS8568	440	850
125	Whse.	MS	440	485
125	G.E.	KF-TEFC	440	3585
125	Al. Ch.	ARW	2200	1750
100	G.E.	IK-Vert.	2300	450
100	G.E.	KT-513	220/440	1750

American Rebuilders Association — Member Body of A.S.A.

BELYEA COMPANY, INC.

OFFICE AND SHOP
43 HOWELL ST., JERSEY CITY 6, N. J.

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CHICAGO Electric Digest

PUBLISHED BY CHICAGO ELECTRIC CO. • THE HOME OF GUARANTEED REBUILT POWER EQUIPMENT

GUARANTEED "REBUILTS" GIVE A-1 PERFORMANCE

SQUIRREL CAGE

MOTORS

3 Phase, 60 Cycle, 220 or 440 Volts (*2200 Volts or higher)

H.P.	Make	Type	Speed
1000	*G.E. (New)	Ks4158	1800
750	*G.E.	KT	720
500	*G.E.	IPO	1800
500	*Fr. Morse	H8	1200
450	*G.E.	KF 5678	1200
400	*Cont. (New)	NZ	1200
400	*G.E.	IK	514
350	*Cr.-Wh.	8C	2600
300	*Westgh.	C8	3600
300	West.	C8	514
300	G.E.	IE K	1200
300	Al.Ch.	AR	900
250	*L.-Allis	OGX-1188	720
250	Al.Ch.	6JHDSWA	1200
250	G.E.	IK	600
200	*G.E.	IK-13B	1800
200	G.E.	IK-17	600
150	G.E.	KT-546	1800
150	G.E.	IEK	1800
150	*Al.Ch.	AN	1800
150	*G.E.	IK	600
125	*A.C.	AR-226	1800
100	*G.E.	FT342Z	1800
100	G.E.	FTHP	1800
100	*Westgh.	C8	1800
100	U.S. (Vert.)	CPU	1200
100	Al.Ch. (new)	AW	1200
100	G.E.	IK15A	1200
100	*West.	C8	1200
75	West.	C8645C	1800
75	G.E.	KT-346	1200
75	Triumph	TR16	514
75	G.E.	IK	600
75	G.E.	IK	514
75	Al.Ch.	AN	1800
60	*Westgh.	C8504	1800
60	A.C. (New)	APZ445B	1800
50	G.E.	KT327	1800
50	U.S. (Vert.)	8CV937	1800

Hundreds of Smaller Motors

SLIP RING

MOTORS

3 Phase, 60 Cycle, 220 or 440 Volts (*2200 Volts or higher)

H.P.	Make	Type	Speed
2500	*G.E.	MT	257
1200	*Cr.-Wh.		240
500	Westgh.	CW	450
400	A.C.	3 Brg.	450
400	*G.E.	MT-412	450
300	*G.E.	IM-15	1200
300	*G.E.	MT-410	450
250	Westgh.	HF15B	600
200	Westgh.	CW	600
200	G.E.	IM	1800
150	Westgh.	CW772C	1200
150	*G.E.	IM-16	600
125	*G.E.	MT-549	1800
125	G.E.	IM17A	900
100	A.C.	ANY	900
100	G.E.	IM	450
75	G.E.	MT547	1200
75	G.E.	MT350	900
75	G.E.	IM	720
75	Star	O8OO	900
60	Westgh.	CW762C	900
60	G.E.	IM11A	1800
50	A.C.	ANY	1800
50	Westgh.	CW636A	1200
50	G.E.	MT348	720
50	G.E.	IM	900
50	G.E.	IM14	435
40	G.E.	MT336	1200
40	Westgh.	CW643C	1200

HI-PRESSURE

PUMPS

GPM	Make	Type	Head
800	Worth.	6D8	925 Ft.
500	Manistee	H	250 Ft.
300	Al.-Ch.	NMZ	800 Ft.

A VIEW OF CHICAGO ELECTRIC'S STOCK

CHICAGO ELECTRIC EXPERTS DO PRECISION REBUILDING

Craftsmanship is a vital part of *Chicago Electric* rebuilding. Each workman's pride in his ability . . . each workman's personal satisfaction in doing a good job has enabled *Chicago Electric* to continually guarantee their service and their rebuilt equipment. The next time you need electrical power equipment call *Chicago Electric*.

CHANDEYSSON ANODIZER

NEW 1000 Amp. 40 volt, type NPT, d/c to 60 HP A-28 Syn. Motor, 3/60/220, 600 RPM, 25°C. continuous.

D. C. MOTORS

ADJUSTABLE SPEED

230 Volts (*115 Volt)

H.P.	Make	Type	Speed
30	G.E.	BF-13	500/1000
20	G.E.	C	200/900
20	A.C.	ER-145	300/1200
15	*Triumph	Planer	225/900
12 1/2/15	G.E.	BC-116	500/1500
10-15	Reliance	185T	400/1600
10	*Elec-D	7⅛S	300/1200
10	G.E.	RF-11A	300/1200
10	G.E.	RD-10A	600/1800

D. C. MOTORS

Mill Type—Pedestal Bearing—Reversing

H.P.	Make	Volts	Speed
3000	Westgh. (Tandem)	525	600
1750	Westgh.	600	550
1500	Westgh.	525	600
1200	Westgh.	525	600
1000	Westgh.	450	600

D. C. MOTORS

230 Volts — Constant Speed

H.P.	Make	Type	Speed
375	Westgh.	Pad	450
200	Westgh.	SK210	900
175	G.E.	ELC11	750
125	G.E.	Marine	1200
100	G.E.	RC34	2500
100	Westgh.	SK173	850
100	A.C.	E152	575
40	Cr.-Wh.	CMC	1750
40	G.E.	CO2004	600
35	Cr.-Wh.	CM351	750
35	G.E.	C	600
30	Westgh.	SK120	975
30	Cr.-Wh.	CCM	450
30	Westgh.	SK933	1750
30	G.E.	RC31B	1150
25	Westgh.	SK113	850
25	Westgh.	SK100L	1100

MANY OTHERS—1 HP and Up! ALSO 115 VOLT

AC SYNCHRONOUS

MOTORS

3 Phase, 60 Cycle, 220 or 440 Volts (*2200 Volts or higher)

H.P.	Make	Type	P.F.	Spd.
1420	*Westgh.	Syn.	.7	900
800	G.E.	TS984	1.0	1800
700	G.E.	TS		514
330	*Al.-Ch.	Dr. Pt.	1.0	720
300	Cr.-Wh.	Reg.	1.0	300
300	*G.E.	ATI	1.0	750
300	G.E.	ATI	.8	900
275	Ideal		.8	257
250	*Al.-Ch.	Dr. Pt.	1.0	720
220	G.E.	ATI	1.0	600
150	*Westgh.	HB	1.0	300
				900
125	Parkinson			900
125	El. Mach.	Syn.	1.0	900
125	Cr.-Wh.	103-S	1.0	900
125	*G.E.	TS	1.0	277
115	K.-M.	KM	1.0	360
100	Cr.-Wh.	103-S	.8	900
100	*G.E.	ATB	.8	900
100	Ideal	SM8	1.0	900
75	G.E.	ATI	1.0	900
40	G.E.	ATB	.8	1200
30	Fynn W.	15VBN		1200
15	Century	ABC385	1.0	1200
4	G.E.	AK (35 cy.)		1500

AC SYNCHRONOUS

GENERATORS

3 Phase, 60 Cycle, 220 or 440 Volts (*2200 Volts or higher)

K.V.A.	Make	Type	P.F.	Spd.
1500	G.E.	ATI	.8	900
112.5	*G.E.	ATB	.8	1200
110	Cr.-Wh.	103	.8	900
100	*G.E.	ATB	.8	900
60	Fr.-Morse	B	.8	900
55	G.E.	ATB	.8	1200
50	G.E.	ATB	.8	1200

ELECTRIC SHOVEL OR CRANE DRIVE

250 V. - VARIABLE VOLTAGE

1—100 KW DC Hoist Generator
1— 25 KW DS Swing Generator
1— 24 KW DC Crown Generator
Driven by
190 HP Syn. Motor, 3/60/2300 v.

MOTORS

1— 75 HP G.E. MDS108 Hoist
1— 30 HP G.E. MD104½ Swing
1— 30 HP G.E. MD104½ Crowd

1000 KW M.G. SET

3-UNIT

2—500 KW West. DC Gens., 275/137.5 V. 3 wire, 1820 Amps.

D/C TO

1420 HP West. Syn. Motor, 900 RPM 11,000 V. 60 Cy., 3 ph. 3 Brg. on Castiron Factory Base.

M. G. SETS

K.W.	Make	A.C.	D.C.
2400	A-C (2-unit)	4800/2400	525
2400	Westgh. (3-u)	4800/2400	600
500	Al. Ch.	2300	250
500	Cr.-Wh.	220/440	250
450	G.E. (3 unit)	2300	125/250
250	West.-G.E.	440	250
200	Ridgeway	2300	250
150	G.E.	2300/440	250
150	G.E.	440	250/275
100	G.E.	440	250
100	G.E.	220	250
100	G.E. Delco	440	120/240
75	Al. Ch.	440	250
60	Al.-Ch.	2300	115
40	Cr.-Wh.	220	125
40	El-P-GE	440	250
28	G.E.	440	250
15	G.E.	220	250
10	G.E.	440	125
10	G.E.	440	250

D.C. TO A.C.

75	Westgh.	110	2300

ROTARY CONVERTERS

1000	G.E.	600 v	DC
500	G.E.	600 v	DC

ENGINE-GENERATOR SETS

KVA	Make	Type	Volts	RPM
100	G.M.	8-268A	480	1200
100	G.M.	6-71BC	480	1200
30	Cum.-Reg.	H-1-6	120/208	1200
15	LeRoi	20-A	120	900
10	Onan	P2SG	115/230	1800
1½ KW	Kohler	D-7501	110 DC	1000
1	Onan	10L-103	115	

TRANSFORMERS

KVA	Make	Ph.	Prim.	Sec.
2000	Pittsb.	1	12000	2300
1000	Westgh.	3	4800	480
850	Westgh.	3	4160	455
500	G.E.	3	13200	445
500	G.E.	3	13800	240/480
300	G.E.	3	2400	240/480
167	Al.Ch.	1	2400	120/240
100	Al.Ch.	1	2400	120/240
75	Al.Ch.	1	2400	120/240
SMALLER RATINGS			2400 to	120/240

PHONE: CANAL 6-2900

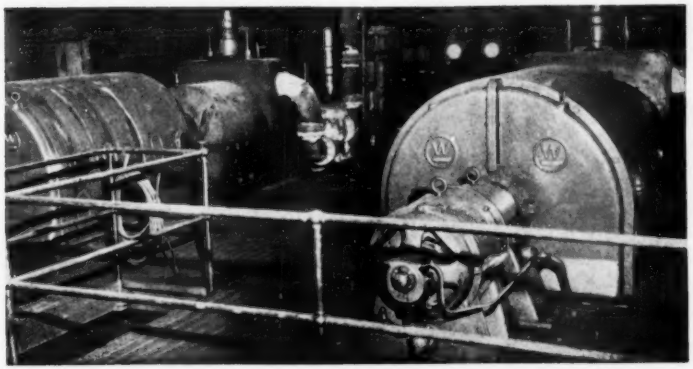
CHICAGO Electric Co.

1320 WEST CERMAK ROAD, CHICAGO 8, ILL.

2500 KVA — WESTINGHOUSE TURBINE-GENERATOR

Non-condensing — 450# psig. with Changes

A MODERN HIGH GRADE UNIT



Above is our 2500-KVA., Westinghouse Non-condensing Turbo-Generator. It is one of the most modern, best conditioned units we have ever owned. Originally, we had two (duplicates): one has been sold to one of the largest Paper Mill Co.'s, and is giving complete operating satisfaction. Unit is good for 450# psig. and 50# B.P., with moderate changes. Voltage 3/60/2400. Is now in dry storage. Had limited service, always proper maintenance. Inspection Reports, Drawings, Complete Specs. on request.

SPECIALS: PRICED FOR QUICK SALES

FAIRBANKS-MORSE DIESEL ENGINE GENERATOR SET, 333-KW., New 1949: Cond. Like NEW.

Condenser Turbines: Any Capacity from 500-KW., to 5000-KW., in Stock.

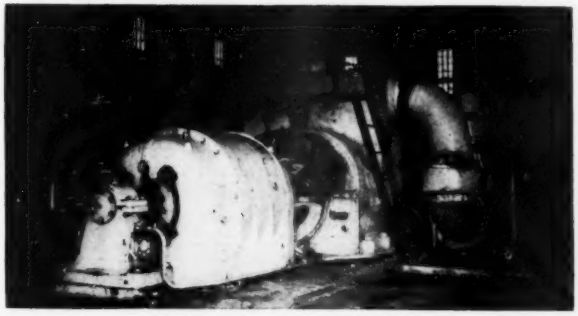
G.E. Turbine only. 2500-KW., 250# psig., Condition Very Good.

3-300-KW., West., Turbine sets, Like New, 250-V., DC., with Switchboards, Condrs., etc., G.E., 2500-KW., Non-cond., 2300, 4160, 6900-V., 150/175-psig., 10/25#BP. Cond. Good.

The 625-KVA., Westinghouse Turbo-Generator, at the right, our own Property, is stored and ready for Immediate Installation. With moderate Changes it is good for 450# psig, 125# back and Voltage is 3/60/2400.

Always used as a Standby unit: Very Limited Service, is like a New Machine.

INSPECTION INVITED.



ADVISE IMMEDIATE INSPECTION IF INTERESTED. ARE YOU?

CONDENSING TURBINE SETS: WE OWN 20 COMPLETE UNITS OUTRIGHT. ALSO HAVE COMPLETE LINES OF BOILERS AND DIESEL ENGINES.

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TELEGRAPH

CHARLES WEAVER

Electrical-Mechanical Engineers

41st Floor Penobscot Building, Detroit 26, Michigan

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" 1-6038

DRAWINGS, COMPLETE DATA, PHOTOS ON ALL UNITS CHEERFULLY FURNISHED

WHAT DO YOU NEED? • SEND US YOUR SPECIFICATIONS

ELECTRIC MOTORS AND GENERATORS

WAGNER CERTIFIED REBUILT

BACKED BY 46 YEARS OF QUALITY AND SERVICE

MAKE OUR SLOGAN YOURS - - - "Check with WAGNER First!"

OVER 46 YEARS OF EXPERIENCE is back of every machine sold by Arthur Wagner Company. Large stocks and modern facilities insure ample choice and prompt service at reasonable cost. All Wagner "Certified Rebuilt" equipment conforms to standards approved by National Industrial Service Association. Inspect our shop and stock—see why it pays to . . . "Check with Wagner First!"

M-G SETS

KW	Mfr.	Input V	Output V
500	Whse.*	2300 AC	250 DC
500	G.E. HCC cont.	2300 AC	275 DC
300	Allis Ch.	2200/440 AC	125/250 DC
300	Whse.*	2200 AC	600 DC
200	Whse.*	2300 AC	275 DC
200	Gen. Elec.*	220/440 AC	125 DC
150	Whse.*	2300 AC	275 DC
150	Whse.*	220/440 AC	125/250 DC
105	Century b.b.	220/440 AC	70 DC
100	Whse.*	220/440 AC	250 DC
100	Delco b.b.	220/440 AC	125/250 DC
100	Allis Ch.	220/440 AC	125 DC
75	Gen. Elec.	220/440 AC	125 DC
60	Gen. Elec.*	220/440 AC	60 DC
50	Allis Ch. (2)	220/440 AC	125/250 DC
50	Whse.	2200/440 AC	250 DC
45	Gen. Elec.*	220/440 AC	60 DC
45	Gen. Elec.	220/440 AC	60 DC
40	Whse.	220/440 AC	125 DC
40	G.E.	220/440 AC	250 DC
35	Cr. Wh. b.b.	220/440 AC	125 DC
30	Elec. Prod.	220/440 AC	50 DC
25	Whse.	220/440 AC	125 DC
25	G.E. b.b. New	220/440 AC	125 DC
25	Reliance b.b.	220/440 AC	250 DC
20	Northw'n.	220/440 AC	250 DC
15	G.E. (2)	220/440 AC	125 DC
15	Star b.b. (2)	220/440 AC	250 DC

*Syn. motor drive.

D. C. MOTORS

HP	Mfr.	Type	Volts	Speed
300	Gen. Elec.	MPC	230	580
200	Reliance	1100T	230	550
150	Gen. Elec.	MPC	230	500/1200
150	Whse.	SK185	230	1150
125	Gen. Elec.	C123	230	325/1000
100	Gen. Elec.	C	230	575/1000
75	Gen. Elec. (2)	CD115	230	1150
60	Cr. Wh.	50H	230	700
60	Reliance b.b.	851T	230	750
50	Gen. Elec.	RLC 204	230	500/1200
50	Gen. Elec.	LC	115	400/800
50	Cr. Wheeler	CMC	230	1750
40	Whse.	8K	230	850
40	Gen. Elec.	RC-32	230	1150
30/50	Gen. Elec.	CD123	230	575/1150
30	Whse.	SK110L	230	1150
30	Whse. (2)	SK90	230	1700
20	Star b.b.	8B	230	1750
30	Gen. Elec.	RC33	230	775
25	Gen. Elec.	CD85	230	1750
25	Whse.	SK150	230	300/1200
25	G.E. b.b. New	CDM93	115	1150
25	Whse.	8K	230	1150
25	Reliance b.b.	92T	230	1150
20	Whse.	SK130	230	500/1500
20	G.E. b.b. (5)	CDM83	230	1150
20	Whse. b.b. (3)	SK97	550	900
20	Gen. Elec. (2)	CD83	230	1750

- EXPLOSION PROOF MOTORS—
- GEARHEAD MOTORS, AC & DC
- FREQUENCY CHANGERS
- CIRCUIT BREAKERS, AC & DC.
- SPEED REDUCERS

D. C. GENERATORS

KW	Mfr.	Type	Volts	Speed
300	Gen. Elec.	MPC	275	700
300	Whse.	8K	600	900
150	Whse.	8K191	125/250	900
125	Gen. Elec.	RC38	250	675
105	Century b.b.	1500 amp.	70	1200
100	Gen. Elec.	C	250	750
100	Allis Ch.	E	125	1200
75	Gen. Elec.	CD	250	1500
60	Gen. Elec.	LC	250	700
50	Allis Ch. (2)	KW	125/250	1200
50	Cr. Wheeler	50H	250	900
40	Whse.	8K	250	1200
40	Gen. Elec. (2)	RC32	250	1500
30	Gen. Elec.	RC32	250	1200
25	G.E. b.b. New	CDM93	125	1750
25	Whse.	8K	250	1450
20	Gen. Elec. (2)	RC	125	1150
20	Gen. Elec. b.b.	CDM	250	1750
15	Cr. Wheeler b.b.	CCD	125	1100
13	Star bb. (3)	8Q	250	1500

A. C. GENERATORS — 60 CYCLE

KVA	Mfr.	Type	Volts	Speed
1000	Whse. syn. cond.		4000/2300	900
625	Gen. Elec.	ATB	2300	450
625	G.E. 25 cycle	ATB	2300	750
500	El. Machy.		480	900
485	Allis Ch.	1 brg.	480	600
312	Gen. Elec.	ATB	240/480	600
275	G.E. 25 cycle	ATI	480	750
250	Whse.	G	2400/480	600
225	Gen. Elec.	ATB	240/480	600
150	Whse.		2300/480	600
125	Gen. Elec. (2)	ATB	240/480	900
112	Gen. Elec.	ATB	240/480	900
90	Gen. Elec.	ATI	240/480	1200
75	El. Machy.		2300	900
56	Gen. Elec.	ATB	240/480	1200
31	Whse. b.b.	late	120/208	1200
10	Kato Now (15)	b.b.	127/220	1800

A. C. MOTORS — SLIP RING
3 Phase 60 Cycle 220 or 440 Volts

QU	HP	Mfr.	Type	Speed
1—	800	G.E. 2300/4000V.	MT	600
1—	500	G.E. 3 brg.	I-M	450
1—	400	Gen. Elec.	I-M	514
2—	350	Gen. Elec.	IM-17A	720
1—	350	Whse. 2300V.	CW	450
1—	300	G.E. 2300V.	I-M	1800

1—	250	Allis Ch. 2200V.	ANT	514
1—	250	Cr. Wheeler	SR	600
1—	200	F. Morse b.b. 2200V.	HV-24C	900
1—	200	Gen. Elec.	IM-17	514
1—	200	Gen. Elec.	I-M	360
2—	200	Gen. Elec.	I-M	600
1—	150	G.E. 2200/4400V. Vert.	I-M	1200
1—	150	Gen. Elec.	I-M-17	450
1—	150	G.E.	IM-16	600
1—	150	Allis Ch. 2200V.	ANT	720
1—	125	G.E. 2200V	IM-15	720
1—	125	Fair. Morse b.b.	HV246B	600
2—	125	Gen. Elec.	I-M-15	900
1—	125	Allis Ch.	ANT	900
1—	125	G.E. 2200V.	I-M	450
1—	100	Whse.	CW356	900
1—	100	Gen. Elec. New	M6324	1200
3—	100	Gen. Elec.	MT358	900
2—	100	Gen. Elec.	I-M	514
2—	100	Gen. Elec.	I-M	1800
2—	100	G.E. 2200V.	MT353	1200
1—	100	G.E. Vertical	MT353	1200
1—	100	Cr. Wheeler	SR	600
1—	100	Northwestern	HW	1800
1—	75	Gen. Elec.	MT358	600
3—	75	Gen. Elec.	MT352	900
1—	75	Whse. 2200V.	CW	600
2—	75	Gen. Elec.	MT343	1800
1—	75	Whse.	CW	720
3—	60	Gen. Elec. enclosed	I-M	514
1—	60	G.E. TEFC b.b.	M-6326	720
1—	60	Fair. Morse	HV	720
1—	60	Whse. 2200V.	CWT16C	900
2—	50	Gen. Elec.	MT342	900
2—	50	Gen. Elec.	MT356	600
3—	40	Whse	CW638A	1200
1—	30	G.E. Int. duty	MTC5312	1200
2—	30	Gen. Elec.	MT326	1200
2—	30	Gen. Elec.	MT332	900
1—	25	Gen. Elec. Int.	MTC5528	720
3—	20	Whse. b.b. New	CW364	1800

A. C. MOTORS — SYNCHRONOUS

HP	Mfr.	Type	Volts	Speed
750	Whse. .8PF	Cond.	4000/2300	900
700	Gen. Elec.	TST659	2200	514
500	Allis Ch.	SPF	440	300
450	Whse.	8PF	2300	900
300	Whse.	G	2200/440	600
275	G.E. 25 cycle	ATI	220/440	750
225	El. Machy.	BRKT	220/440	1800
220	G.E. 3 brg. .8PF	ATI	220/440	600
220	G.E. .8PF	ATI	2200	900
200	G.E.		220/440	150
199	El. Machy.	3 brg.	220/440	514
175	Gen. Elec.	ATI	2300/550	450
175	Whse.	2 brg.	220/440	360
150	Gen. Elec.	ATI	220/440	900
125	El. Machy. (2)		220/440	1800
120	Burke b.b. .8PF	AC19	2200/440	1200
100	American b.b.	VGH	220/440	1 90
90	Gen. Elec.	TST545	220/440	1200
80	Gen. Elec.	ATI	2200/440	1200

A. C. MOTORS — SQUIRREL CAGE
3 Phase 60 Cycle 220 or 440 Volts

QU	HP	Mfr.	Type	Speed
1—	500	G.E. 6600/4000 V.	I-K	1800
1—	300	G.E. 2200V.	KTF561	1800
2—	250	Whse.	CS	720
1—	250	L. Allis b.b. 2200V	04GS	1800
1—	250	Whse. 2200V.	CS	1200
1—	250	Gen. Elec.	IK-17	600
1—	250	G.E. 2200/440V.	KT413	450
1—	200	G.E. 4000/2200/440V.	KT413	360
1—	200	Gen. Elec.	IK-17	514
1—	200	Reliance b.b. New	B60858	1800
1—	200	Gen. Elec.	I-K	600
1—	200	Gen. Elec.	I-K-E13B	1800
1—	200	Whse. 2200V. Ex. Pf.	CS81208	1200
1—	150	Gen. Elec.	K558	900
1—	150	Allis Ch. 2200V.	ARW	3600
1—	150	Reliance b.b. New	B5085	1800
1—	150	Reliance b.b. New	C6085	900
1—	150	Gen. Elec.	KT549	1800
2—	150	Gen. Elec. 2200V.	IK-15A	720
1—	150	Reliance b.b. New	B6085	1200
1—	150	Gen. Elec. TEFC b.b.	K6338	1200
1—	150	Whse	CS	720
1—	125	Al. Ch. 2200V. b.b.	ARX-826	900
1—	125	Rel. TEFC New	B60858	1800
2—	125	Gen. Elec.	K-558	900
1—	125	Allis Ch. Vertical	ARV226	1200
1—	125	G.E. New b.b. HT	KG6324	1200
1—	125	Cor. 2200V. b.b.	SC	1800
2—	125	G.E. 2200V. TEFC	K6326	3600
1—	100	Reliance b.b. New	50848	1800
1—	100	Reliance TEFC New	B5085	1200
1—	100	Whse.	CS	720
1—	100	Gen. Elec.	IK-15	600
2—	100	Gen. Elec.	IK-14	900
1—	75	Reliance b.b. New	C7085	900
1—	75	Gen. Elec.	KT529	3600
1—	75	G.E. 2200V.	KF546	900
1—	75	Lima b.b.	R8505	1200
1—	75	Whse. Expl. Prf. New	CS605	1200
1—	75	Wagner	22VRM	1800
1—	75	Rel. TEFC New	5018	3600
2—	75	G.E. TEFC 2200V. New	K-6325	900
2—	75	Gen. Elec.	I-K-14	600
2—	75	Reliance b.b. New	CB4458	1800
1—	75	Reliance TEFC	C5084	1200
3—	75	G.E. Vertical	KT543	1200
2—	75	U.S. b.b. NEW	SC505	1200
1—	60	G.E. 2200V.	KT533	1800
1—	60	Gen. Elec.	KT544	900
3—	60	F. Morse b.b.	HO-166B	900
1—	60	Gen. Elec.	KT556	450
1—	60	Reliance b.b. New	CC505	900
1—	60	G.E.	KT536	450
1—	60	Gen. Elec.	I-K	600
1—	60	G.E. Vertical	KT538	1200
1—	60	Reliance b.b. NEW	B504	1800
1—	60	Allis Ch. TEFC	ARZ	3600
2—	50	Howell b.b.	SCBB	3600
2—	50	Gen. Elec.	KT546	720
1—	50	Gen. Elec.	KT552	600
1—	50	G.E. Vertical	KT548	720
1—	50	Star b.b.	N505	1200/720
1—	50	Reliance b.b. New	CC504U	900
2—	50	Whse	CS	1200
2—	50	Howell TEFC	K445	1800
1—	50	Gen. Elec.	KT537	1800
1—	50	Reliance b.b.	C505	900
1—	50	Whse. hiterq	C8506	900
1—	40	G.E. 2200V.	KT532	1800
2—	40	Reliance b.b. New	CB404	1200
2—	40	Reliance b.b. New	CB365	3600
2—	40	Gen. Elec.	KT532	1200
2—	40	Gen. Elec.	KT348	600
1—	40	Whse. b.b.	CS-504	1200/600
1—	30	Louis Allis	HD	900/450

A. C. MOTORS — 25 CYCLE

HP	Mfr.	Type	Volts	Speed
275	G.E. syn.	ATI	440	750
150	Whse.	HF	440	300
60	Allis Ch.	ARY	440	1800
50	Gen. Elec. Int	MTC5337	440	750
30	Gen. Elec.	MT343	440	750

Arthur Wagner Co.

1435 W. RANDOLPH ST. MO nroe 6-7405 CHICAGO 7, ILLINOIS

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2 MODERN PACKAGE TURBO-GENERATOR SETS

with self contained condensers

1350 K.V.A.—BUILT 1943

TURBINES: Westinghouse, Serial No. 2-A-9593-99 & 2A-9593-100. Impulse reaction type—7 stages condensing—3500 H.P.—4800 R.P.M. Steam pressure 440 P.S.I.—Exhaust pressure 27½" vacuum. Temp. 740°—weight 13000 lbs.

GENERATORS: Westinghouse, Serial No. 109S20P900 & 108S20P900—3 phase two pole type—2550 K.V.A.—82½ cycles—2210 volts—100% P.F.

THESE GENERATORS CAN BE RE-WOUND FOR APPROX. 1350 K.V.A.—3 PHASE—60 CYCLE 2300 OR 440 VOLT OPERATION WITH TURBINE SPEED REDUCED TO 3600 R.P.M.

CONDENSERS: Westinghouse—2 pass—2200 Sq. ft.—vacuum 27½"—¾" tubes 12 ft. long—weight, 26,700 lbs. Condensers mounted below turbine. Oil Pump & oil cooler mounted directly on unit. Unit completely mounted on pre-fab sub-base.

THESE UNITS CAN BE DELIVERED RE-WOUND IN A VERY SHORT TIME.

6 B&W BOILERS

cross drum sectional header

BUILT 1943 — IMMEDIATE DELIVERY

Heating Surface	11417 sq. Ft.
Design Pressure	200 P.S.I.G.
Working Pressure	200 P.S.I.G.
Capacity	75,000 lbs./hour
Steam Temperature	Saturated
Furnace Volume	1024 Sq. Ft.
Feed Temperature	200°
Oil Burners	8 per boiler

BOILER DIMENSIONS

19' 4" wide, 16' 4½" high, 15' deep

BOILER TUBES

1667—1¼" straight, 12' 2" long
825—1¼" bent; 122—2" straight
(first 2 rows above fire box)
Downcomer & Uptake Tubes
4" & 4½" bent

WATER WALL SIDES IN FURNACE

HYDROSTATICALLY TESTED NOV. 1951 BY PRUDENTIAL LIFE INSURANCE CO.

3 MODERN TURBO—GENERATOR SETS

250 K.W.
440/3/60
1200 R.P.M.

TURBINES: Worthington-Moore, 440 lbs. W.P., 740° T.T., Serial No. 7454—7452—7432, type S4—5 stage condensing—28.5" Vac.—turbine speed 6097—gear speed 1200. Westinghouse-Moore reduct. gear 6097/1200.

GENERATORS: Westinghouse, 312 K.V.A.—250 K.W.—3/60/440 1200 r.p.m.—400 amps.—80% P.F.—125 volts d.c. excitation—exciters direct connected 5.5 K.W.

UNIT IS MOUNTED ON PRE-FAB SUB-BASE. BUILT-IN OIL COOLERS. THESE ARE MODERN UNITS RECENTLY REMOVED FROM A NAVAL VESSEL.

16 MILL MOTORS—*Complete With All Controls*

50 H.P.—230 VOLTS D.C.—600 R.P.M.

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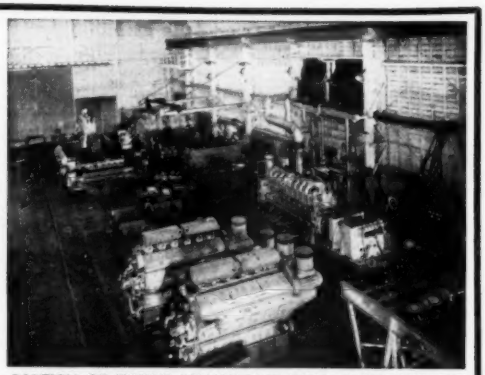

PORTION OF ENGINE REMANUFACTURING FLOOR AND ONE OF THE ENGINE TEST STANDS AT OUR SAUSALITO, CALIF. PLANT.

A PARTIAL LIST OF OUR INVENTORY

KW	MAKE	MODEL	HP	RPM
1500	Fairbanks Morse	33E16	2000	300
1230	Nordberg	F6G168SC	1750	327
1136	Fairbanks Morse	38D	1600	720
1000	General Motors	16-278A	1600	720
750	General Motors	12-567	1080	720
500	Alco	6-12-1/2x13T	750	600
500	Worthington	EE	750	327
500	General Motors	8-567	720	720
340	Baldwin	VO-6	510	450
320	Buckeye	80	480	600
300	Enterprise	DSG-6	450	450
300	General Motors	8-268A	450	1200
264	Superior	KNA	396	514
167	Ingersoll-Rand	S	255	600
160	Buckeye	80	240	600
100	General Motors	3-268A	150	1200
100	Worthington	BB-5	150	600
60	General Motors	6-71	90	1200
50	Caterpillar	D-8800	76	1200

ALTERNATING AND DIRECT CURRENT UNITS
STANDARD AND SPECIAL VOLTAGES AS REQUIRED

ONE YEAR GUARANTEE!

TURBINE GENERATOR UNITS
3 Phase 60 Cycle

25000 KVA G.E. Cond. 250 lbs. 13200 V.
18750 KVA A.Ch. Cond. 200 lbs. 13200 V.
6250 KVA A.Ch. Cond. 200 lbs. 4160 V.
5000 KVA G.E. Non-cond. Extr. 600 lbs.—125 lbs. Extr. 50 lbs. Exh. 13800 V.
5000 KVA West. Cond. Extr. 300 lbs.—25 lbs. Extr. 600 V.
3750 KVA A.Ch. Non-cond. Extr. 400 lbs.—170 lbs. Extr. 50 lbs. Exh. 13800 V.
3125 KVA G.E. Cond. Extr. 800 lbs.—175 lbs. Extr. 2300 V.
2500 KVA G.E. Cond. 150 lbs. 2300 V.
1563 KVA G.E. Cond. Extr. 200/400 lbs.—15 lbs. Extr. 2400 V.
1563 KVA West. Cond. Extr. 200/400 lbs.—15 lbs. Extr. 2400/4150 V.
1250 KVA West. Cond. 450 lbs. 2400/4160 V.
1250 KVA West. Cond. Extr. 200 lbs.—20 lbs. Extr. 480 V.
625 KVA West. Non-cond. 200 lbs.—15 lbs. Exh. 480 V.

ENGINE GENERATOR UNITS
3 Phase 60 Cycle

825 KVA Hamilton Corliss 200/15 lbs. 480 V.
750 KVA Ames vert. Uniflow, 150/5 lbs. 2400 V.
625 KVA Skinner vert. Uniflow, 150/5 lbs. 480 V.
625 KVA Skinner Uniflow, 150/5 lbs. 240 V.
312 KVA Skinner Uniflow, 150/3 lbs. 480/240 V.

DIESEL GENERATOR UNITS
3 Phase 60 Cycle

1400 KVA Enterprise, 2400 V. 327 rpm.
1250 KVA Nordberg, 2300 V. 257 rpm.
1250 KVA General Motors, 2400 V. 720 rpm.
700 KVA Fairbanks-Morse, 2400 V. 300 rpm.
600 KVA Fairbanks-Morse, 2400 V. 300 rpm.
475 KVA Cooper-Bessemer, 2400 V. 400 rpm.

SYNCHRONOUS CONDENSER

7500 KVA G.E., 3 phase 60 cycle, 13800/6900/4000/2300 V. 720 rpm.

STEAM BOILERS

100,000 lbs. per hr. B. & W., 600/800 lbs. pulverized fuel
67,500 lbs. per hr. B. & W., 475 lbs. gas or oil
50,000 lbs. per hr. B. & W., 420 lbs. pulv. fuel
30,000 lbs. per hr. B. & W., 435 lbs. gas or oil
10,000 lbs. per hr. B. & W., 450 lbs. gas

TRANSFORMERS
60 Cycle

1—12000 KVA G.E. 3ϕ, 138,000/69000—13800 V.
2— 3700 KVA G.E. 1ϕ, 13800/12000—2400/4160 V.
3— 3333 KVA G.E. 1ϕ, 11000/33000—2400/4160 V.
3— 1000 KVA G.E. 1ϕ, 33000—2300 V.
1— 750 KVA G.E. 3ϕ, 13200—2200 V.
3— 500 KVA West. 1ϕ, 33000—2300 V.
3— 150 KVA A.Ch. 1ϕ, 13800—240/480 V.

GENERATORS
3 Phase 60/240 Cycle

2250 KVA G.E. 60 cy. 2400/480 V. 3600 rpm.
2859 KVA (3) G.E. 180/240 cy. 2300/4150 V. 3600/4800 rpm.

INTERNATIONAL POWER MACHINERY CO.

1609 UNION COMMERCE BLDG. Telephone: MAin 1-9514 CLEVELAND 14, OHIO

STEAM POWER PLANT

5—714 HP Combustion Engineering WATER TUBE BOILERS, with Ebasco Superheaters, Sturtevant High Pressure Economizers, Green Chain Grate Stokers, Hagan Combustion Controls, Copes Feed Water Regulators, Clarage Forced Draft Fans, Sturtevant Induced Draft Fans, Smoke Stacks. Good for 250# pressure by Hartford.

1—705 HP Stirling 4 drum Boiler with B&W Superheater, Green Chain Grate Stoker, Sturtevant Economizers, Sturtevant Induced Draft Fan, with Smoke Stack. Good for 250# pressure by Hartford.

2—8000 HP Webster Water Heaters.

1—McCaslin Pivoted Bucket Conveyor System for handling coal and ashes. Approximately 300' long.

6—Steel Coal Bunkers, 80 tons each.

1—36" Wheeler Single Stage Circulating Pump, 30,000 GPM direct connected to 300 HP Allis-Chalmers Motor. 3/25/440, 360 RPM. (Has extra impeller for 15,000 GPM)

1—4"x6" Dayton-Dowd Centrifugal Pump direct connected to 125 HP General Electric-Curtis Steam turbine.

1—100 KW General Electric 125 Volt DC Generator direct connected to a General Electric-Curtis Steam Turbine, 2-stage with reduction gear. Type SG, 3600 to 1200 RPM.

1—Type TA-60 Wheeler Turbo Air Pump direct connected to 75 HP General Electric-Curtis 2-stage Steam Turbine, 1750 RPM.

1—6" Wheeler Centrifugal Condensate Pump direct connected to a 20 HP General Electric-Curtis 2-stage Steam Turbine, 1800 RPM.

1—Combination Circulating Pump and Condensate Pump driven by 100 HP General Electric single stage Steam Turbine through a Westinghouse Reduction Gear, 3500 to 700 RPM.

1—2" 2-stage LeCourtney Centrifugal Pump, 200 GPM 650' Head at 3700 RPM direct connected to 53 HP Westinghouse Steam Turbine.

1—3000 KVA General Electric Synchronous Converter, Type HCC, 6 phase, 25 cycle, 250 RPM, 600 Volts DC with 1—3150 KVA General Electric Transformer, 3 phase, 25 cycle, 6600/13200-445 Volts with starting panel and all instruments.

1—1000 KVA General Electric Synchronous Converter, Type HCC, 6 phase, 25 cycle, 750 RPM, 600 Volts DC with 1—1050 KVA General Electric Transformer, 3 phase, 25 cycle, 13200/445 volts with starting panel and instruments.

1—500 KW Westinghouse Synchronous Converter, 6 phase, 60 cycle, 1200 RPM, 600 Volts DC with starting panel and instruments.

1—4000 KVA Westinghouse Transformer, 3 phase, 25 cycle, 13200/6600 volts.

7—700 KVA Westinghouse Transformers, single phase, 25 cycle, 7620/6600 volts to 13200 volts.

1—Kennecott Pressure Type Industrial Water Filter.

1—50-Ton Electric Traveling Crane—55'5½" Span.

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MORSE BROS. MACHINERY COMPANY

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MOTOR GENERATORS

1—400 KW G.E. Syn. 600 V. 720 RPM
1—300 KW G.E. Syn. 250 V., 1200 RPM
2—300 KW WEST. Syn. 250 V., 1200 RPM
1—300 KW RIDGWAY Syn. 250 V., 1200 RPM
1—240 KW G.E. Syn. 250 V., 1200 RPM
1—200 KW G.E. Syn. 250 V., 1200 RPM
1—200 KW RIDGWAY Syn. 250 V., 900 RPM
1—150 KW G.E. Syn. 250 V., 1200 RPM
1—150 KW WEST. Syn. 250 V. 1200 RPM
1—100 KW RIDGWAY Syn. 250 V. 1200 RPM
2— 50 KW G.E. Ind. 250 V. 1200 RPM

ROTARY CONVERTERS

1—500 KW WEST. Syn. 250 V., 1200 RPM
1—300 KW WEST. Syn. 250 V., 1200 RPM
2—300 KW AL-CH. Syn. 250 V., 1200 RPM
1—150 KW G.E. Syn. 250 V., 1200 RPM

WALLACE E. KIRK COMPANY

502 Grant Bldg., Pittsburgh 19, Pa.

COMPLETE DIESEL PLANT

3—Fairbanks Morse units. 805 HP—556 KW; 690 HP—473 KW; 300 HP—200 KW. Model 33-E-14. 3/60/2400 volts. New 1940. Will sell all or part. With auxiliaries. Condition excellent.

MISSISSIPPI VALLEY EQUIPMENT CO.

507 Locust St. St. Louis 1, Mo.

ELECTRICAL EQUIPMENT

Motors—Generators—M-G Sets—Transformers—Controls—Electrical Equipment—Rebuilt and Guaranteed

REBUILT AND GUARANTEED

PROMPT SHIPMENT — PARTIAL LISTING

250 VOLT DYNAMOMETERS

Cradle Type With Scale and Control

Write for Complete Specifications

Qw.	Make	HP	RPM	Type
1	G.E.	150	2200/5000	TLC-50
2	West.	150	2200/5000	SK-131
1	G.E.	200	1200	C

SLIP RING MOTORS—3 Ph., 60 Cy.

Qn.	HP	Speed	Volts	Make	Type
6	7½	870	440	G.E.	MTC-620
2	10	1140	440	West.	HF-7A
2	10	870	220	G.E.	MT-11
2	11½	870	440	G.E.	MTC-560S
1	15	870	220	West.	CW-640
1	15	680	440	West.	MW-516
1	20	870	440	West.	CW-648
2	25	1150	550	G.E.	MT-525
2	25	850	220	Wagner	BR
2	25	720	440	Wagner	22VBR
1	30	885	440	West.	CW-646
1	30	850	440	G.E.	MT-552
1	30	675	440	G.E.	MT-556
2	40	900	440	K-M	HV-H16A
1	40	865	2300	Al. Ch.	ARV-223C
1	40	860	440	G.E.	MT-540
1	50	1150	440	G.E.	MT-550
1	50	870	440	G.E.	MT-552
1	60	885	440	West.	CW-758
1	60	570	550	G.E.	MTC-5546
1	60	445	600	West.	CW-938
1	80‡	575	440	G.E.	MTC-5352
2	125	430	440	G.E.	IL-16
2	150	1780	440	G.E.	MTT-549
1	175	900	550	West.	CW-1002
1	200	445	2200	G.E.	IM-17A
1	200	900	2300†	G.E.	IM-17
1	300	900	440	G.E.	IM-17
2	300	880	2200	G.E.	IM-17A
4	350	1775	2300	G.E.	IM-E15A
1	400	600	550	West.	CW
1	600	1770	440*	G.E.	IM-E15C
1	700	735	4000‡‡	West.	CW

220 volt motors can be reconnected for 440 volts. ‡Intermittent rating. ‡‡25 cycle.
**New. †Also 440 or 550 volts.
*Also 2300 volts.

A.C. GENERATORS — NEW

3 Phase, 60 Cycle, 0.8 P.F., Two Bearing, with Damper Winding — Direct Connected Exciter.

Qn.	KVA	RPM	Make	Volts
2	18.7	1800	Columbia	240/120
4	18.7	1800	Columbia	208/120

230 VOLT CONST. SPEED D.C. MOTORS

Qn.	HP.	Speed	Make	Type
10	¾	850	Reliance	T-23T
6	3½	850	West.	SK-30
1	7½	1150	G.E.	CDM-66
2	7½	850	G.E.	CD-75
10	10**	1750	Kimble	BA-534
5	10**	1150	Al. Ch.	ED-80
2	10	850	West.	SK-83
10	13¼**	900	West.	SK-92
3	15	1750	G.E.	CD-75
1	15	825	West.	SK-90
1	20	1750	L.A.	ONA-L851
1	20**	1400	G.E.	CDM-83
1	20	1750/1310	West.	SK-83
2	20	1150	G.E.	KC-30
1	20**	1450	G.E.	CDM-83
11	20	750	West.	SK-110L
17	25	825	West.	SK-120
1	30	1100	G.E.	KC-12
1	40	1700	West.	SK-103
1	40	750	G.E.	KC-34
1	50	750	West.	SK-150
1	90	650	G.E.	KC-16
2	200	1150	G.E.	KC-38
1	250	1150	G.W.	CMC-101

230 VOLT ADJ. SPEED D.C. MOTORS

Qn.	HP.	Speed	Make	Type
8	5/7½	600/1800	G.E.	RA-30
1	10	400/1600	Reliance	T-92T
1	12½	280/840	West.	SK-130
1	15	600/1200	West.	SK-100L
1	20	500/1500	G.E.	RF-11
1	20/25	300/1200	West.	SK-153
1	25	400/1600	G.E.	RF-13
1	25	500/1500	G.E.	RF-12
1	25/42	300/1200	G.E.	RF-13
1	30/40**	400/1600	G.E.	CD-1238
1	35	500/1800	West.	SK-143
1	40/50	400/1200	West.	SK-163
1	75	375/750	Cr. Wh.	CMC-125H
3	100	225/900	G.E.	MPC-A
3	100	400/1200	Al. Ch.	
1	100	320/960	West.	SK-200
1	125	450/1000	West.	SK-190
1	175	320/500	West.	SK-220
2	375	350/500	G.E.	MPC

**New

SQUIRREL CAGE MOTORS—3 Ph., 60 Cy.

Totally Enclosed Fan Cooled, Ball Bearing

Qn.	HP	RPM	Volts	Make	Type
4	2	1140	220	L.A.	JS 225Y
3	3	1160	440	L.A.	JS-254
4	5	1730	440	G.E.	K-254
2	7.5	1740	440	G.E.	K-284
1	10	1735	440	West.	CS-324
1	10	1140	440	Wagner	CP2-326
1	15	1175	440	L.A.	JA-365
1	20	1760	220	G.E.	K-364
1	25	1200	550	G.E.	K-405
2	25	1170	220	L.A.	JX-405
1	25	705	440	West.	CS-W504

SPLASHPROOF, BALL BEARING

Qn.	HP	RPM	Volts	Make	Type
1	3	1160	440	L.A.	FS-254
23	5	1730	440	G.E.	FS-254
1	5	1735	220	G.E.	K-254
1	5	1160	440	L.A.	FX-284
4	15	1150	440	L.A.	FX-365
1	50	1760	440	L.A.	FX-445A
5	50	1160	220	G.E.	K-504
1	150	1775	440	L.A.	FX-1168
5	150	880	440	L.A.	FX-1368
1	150	700	440	G.E.	KF-6335

OPEN TYPE MOTORS

Qn.	HP	Speed	Volts	Make	Type
3	10	3500	440	G.E.	KT-56
5	15**	1735	440	Century	BC326
1	15	1200	220	G.E.	KT-502
1	15	900	220	G.E.	FTR-512
1	20**	3475	220	West.	CS-320
1	20**	1750	440	Wagner	HPI-364
2	20	1750	220	West.	CS-W364
1	20	1200	220	G.E.	KT-512
2	20	1160	440	West.	CS-464C
2	30	900	220	G.E.	FTR-522
5	25**	1740	440	Century	SC-364
1	25	1160	440	West.	CS-467C
1	25	900	220	Howell	SCRB-556***
1	25**	875	440	Master	FB-405
2	25	575	440	G.E.	KT-542
3	30	3550	550	G.E.	K-3648
1	30	1755	220	G.E.	FT-513
1	30	1160	440	West.	CS-644
1	30	870	220	West.	CS-646
1	40**	3545	220	G.E.	KF-4048
2	40	1750	440	West.	CS-583C
2	40	900	2300	G.E.	FTR-536
4	50**	1750	440	Wagner	HPS-405
2	60*	1750	440	Ideal	AH-444
2	60	900	440	G.E.	KT-546
1	75	1775	440	West.	CS-585
1	75	1175	440	West.	CS-662C
2	75	870	220	West.	CS-766A
2	75	865	2300	G.E.	KT-552B
1	100	900	2200	West.	CS-930
2	100	495	2200	Al. Ch.	AN
8	125	1750	2200	Al.-Ch.	AR
1	125	435	440	Al.Ch.	AS
2	125	400	2300	G.E.	I-17-FR
1	200	580	550‡‡	G.E.	KT-5568
2	300	587	2200	West.	CS-39A
1	500	1200	140	G.E.	KTP-567
1	700	1800	2300/ 4000	West.	CS-4-39D12

220 volt motors can be reconnected for 440 volts. **New. ***2 Phase. ‡‡Reconnectable for 440 volts.

MOTOR GENERATOR SETS

125 and 250 Volts D.C.

(Write for complete Specifications)

KW	Make	RPM	DC Volts	AC Volts
2	Cont.	1750	125	220/440
7.5**	West.	1455	125	380/220‡
10	West.	1750	125	220/440
15**	G.E.	1725	125	220/440
15	G.E.	1755	250	220/440
15	West.	1450	125	220/440‡
16	West.	1750	125	2200/440
25	G.E.	1200	125	220/440
30	Al. Ch.	1750	125	220/440
50	G.E.	1720	125	220/240†
75	G.E.*	1200	125	220/240
100	West.	1160	125/250	2300/4100

Note: 3KW, 5KW & 7.5KW, 250V Sets Available.
**New. *Synch. Motor Driven. ‡50 Cy. †25 Cy.

Above Items Represent a Partial Listing Only. Your Inquiries Will Receive Our Prompt Attention. All Equipment is Located in Our Cleveland Warehouse. We have Controls for Most Items Listed.

ELECTRIC GENERATOR & MOTOR CO.

4521 HAMILTON AVENUE • CLEVELAND 14, OHIO

SLIP RING MOTORS

220 or 440 volt, 60 cycle, 3 phase, slip ring Motors Rebuilt

H.P.	MAKE	TYPE	SPEED	DESCRIPTION
400	G.E.	I-M	1200	S. B.
300	G.E.	I-M	1200	S. B.
200	G.E.	I-M	1200	S. B.
150	G.E.	I-M	1200	S. B.
150	G.E.	I-M	1800	S. B.
100	G.E.	MT-300	1800	S. B.
100	G.E.	I-M	900	S. B.
100	G.E.	I-M	720	S. B.
100	G.E.	MT-343	1200	S. B.
75	G.E.	I-M	900	S. B.
75	West.	CW	720	S. B.
75	G.E.	I-M	720	S. B.
60	G.E.	MT-333	1800	S. B.
40	G.E.	I-M	1800	S. B.

BRAND NEW SQUIRREL CAGE MOTORS

Totally enclosed, fan cooled, explosion proof, open 220 or 440 Volt, 60 Cycle, 3 Phase

H.P.	MAKE	TYPE	SPEED	DESCRIPTION
150	G.E.	K-6326	3600	TEFCBB
150	G.E.	K-6328	1800	TEFCBB
125	G.E.	K-6328	1200	TEFCBB
100	West.	CS-6078	1800	TEFCBB
100	West.	CS-504	1800	B. B. open
75	West.	CS-504	3600	TEFCBBXP
75	A.C.	ARZ	1800	TEFCBB used
75	West.	CS-504	1800	TEFCBBXP
75	West.	CS-445	1800	B. B. open
75	F.M.	QS-445	1800	B. B. open
75	West.	CS-605	1200	TEFCBBXP
60	West.	CS-5045	1800	TEFCBBXP
60	G.E.	K-5045	1800	TEFCBBXP
60	L.A.	80-44	1870	B. B. open
60	F.M.	QS-444	1800	B. B. open
50	Master	FB-404	3600	TEFCBBXP
50	G.E.	K-445	1800	TEFCBB
50	G.E.	K-405	1800	S. B. drip
50	West.	CS-445	1200	S. B. open
50	G.E.	K-505	900	TEFCBBXP
40	A.C.	AR-444	3600	TEFCBBXP
40	G.E.	KF-3655	3600	B. B. splash
40	West.	CS-405	1800	TEFCBB
40	L.A.	K-405	1800	TEFCBBXP
40	G.E.	404	1800	B. B. open
40	Cr. Wh.	SC-445	1200	TEFCBB
30	G.E.	KF-3655	3600	B. B. splash
30	West.	CS-3655	3600	B. B. splash
25	Line.-Weld	DBD-328	3600	B. B. open
25	West.	CS-384	1800	S. B. splash
25	G.E.	K-364	1800	S. B. drip
20	G.E.	K-364	1800	S. B. drip
20	L.A.	EX-364	1800	TEFCBBXP
20	G.E.	KF-404	1200	TEFCBBXP
20	G.E.	KD-405	900	TEFCBBXP
20	G.E.	KF-405	900	TEFCBBXP
15	L.A.	EX-326	1800	TEFCBBXP
10	West.	CS-2842	3600	TEFCBB
10	Howell	EKBB-28-5	1800	TEFCBBXP
10	Reliance	AA-CB-324	1800	TEFCBB
10	West.	CS-324	1800	TEFCBB
10	West.	CS-324	1800	B. B. open
10	L.A.	EX-328	1200	TEFCBBXP
10	G.E.	K-364	900	S. B. drip
10	L.A.	R-1835	600	TEFCBB
3	G.E.	K-224	3600	TEFCBBXP
3	L.A.	EX-225	1800	TEFCBBXP

SQUIRREL CAGE MOTORS REBUILT

220 or 440 Volt, 60 Cycle, 3 Phase, Open

H.P.	MAKE	TYPE	SPEED	DESCRIPTION
200	Wagner	RP-2-28	1800	S. B.
200	Wagner		1200	S. B.
200	G.E.	K-364	600	B. B. new
150	West.	CS	1800	S. B.
150	G.E.	I-K	1200	S. B.
150	G.E.	I-K	720	S. B.
100	West.	CS	1800	S. B.
100	G.E.	I-K	1800	S. B.
100	G.E.	I-K	1200	
100	G.E.	KT-347	1200	S. B.
100	West.	MS	1200	S. B.
100	West.	CS	900	S. B.
100	G.E.	I-K	720	S. B.
75	West.	CS	1800	S. B.
75	West.	CS	1200	S. B.
75	G.E.	I-K	900	
75	G.E.	KT-343	1200	S. B.
75	West.	CS-WL-607	1200	S. S. B.
75	G.E.	KT-552	900	S. B.
75	G.E.	KT-552	900	S. B.
75	G.E.	KT-346	720	S. B.
60	G.E.	KT-333	1800	S. B.
60	G.E.	I-K	1200	S. B.
60	West.	CS	1200	S. B.
60	G.E.	KT-346	900	S. B.
60	G.E.	I-K	900	S. B.
50	G.E.	I-K	1800	S. B.
50	Cr. Wh.	25R	1800	S. B.
50	G.E.	KT-327	1800	S. B.
50	G.E.	KT-336	1200	S. B.
50	West.	CS	1200	S. B.
50	G.E.	KT-342	900	S. B.
50	G.E.	KT-346	900	S. B.
40	G.E.	K-444	1800	B. B.
40	G.E.	KT-323	1800	S. B.
40	West.	CS	1200	S. B.
40	G.E.	KT-336	900	S. B.
40	F.M.	B-H12D	900	S. B.
40	G.E.	KT-542	720	S. B.
35	Triumph	B-12	900	S. B.
35	G.E.	I-L	900	S. B.
35	G.E.	I-K	720	S. B.
30	G.E.	KT-312	1800	S. B.
30	West.	CS	1200	S. B.
30	G.E.	KT-332	900	S. B.
25	G.E.	KT-312	1800	S. B.
25	West.	CB-471	1800	S. B.
25	Century	SC-30	1200	S. B.
25	G.E.	I-K	720	S. B.
25	F.M.	B-H12-B	720	B. B.
20	West.	CS-384	1800	S. S. B. splash

We have in stock explosive proof motors 220/440/60/3 ranging in HP from ½ to 50 HP 900 to 1800 RPM.
We also carry in stock a large quantity of used electric motors from 1 HP up to 500 HP., generators, transformers and control equipment. Upon receipt of your inquiries, we shall be glad to quote.

POWER EQUIPMENT COMPANY

8 CAIRN STREET — P. O. BOX 534 — ROCHESTER 2, N. Y.

Telephone: Genesee 5629

TRANSFORMERS

BOUGHT AND SOLD

We carry a large stock of transformers, and invite your inquiries. New Transformers built to your specifications.

PIONEER TRANSFORMER REBUILDERS

We rewind, repair and redesign all makes and sizes.

One Year Guarantee.

THE ELECTRIC SERVICE CO., INC.

"AMERICA'S USED TRANSFORMER CLEARING HOUSE"

SINCE 1912 — CINCINNATI 27, OHIO

DIESEL GENERATOR SETS

100 KW General Motors Model 3-268A direct coupled to: Westinghouse Alternators, 3/60/440 V., 1200 RPM. Inc. Switchboards. Rebuilt.

60 KW General Motors set, Model 6-71, 6 Cyl., 3/60/120/208 V., 1200 RPM.

50 KW Int'l. Harvester set, Model UD-14, 4 Cyl., 3/60/120/208 V. Rebuilt.

Other sizes in stock, AC & DC Units

ALJON ELECTRIC DIESEL CO.

904 Pacific St., Brooklyn 16, N. Y.

STerling 3-6515

COMPLETE POWER PLANTS

STEAM — ELECTRIC — HYDRO — DIESEL

"Export Orders Carefully Executed"

IMMEDIATE DELIVERY

1—50,000# hr. 4-Drum Stirling type, 250# Boiler (8,500 sq. ft. H.S.) Superheat. Condition excellent, ASME, any fuel, now oil fired.

1—80,000# hr. Steam Generator 350#, Very efficient, economizer, air heater, etc. Steel cased, excellent condition.

768 HP B&W Sterling Boiler, 200#, with new tubes & superheaters.

● We have many other boilers in sizes of 250 to 900 HP, 200 to 450# pressure. See our September Power ad.

Turbo-Generators, Condensing, 300 to 10,000 KW. Non-Condensing, 200 to 2500 KW. Frequency Changers

TRANSFORMERS! Quick Delivery, Various Sizes Rebuilt like NEW—Guaranteed.

Motor-Generators & Diesel-Generators See Our September Power Ad

Send us your INQUIRIES for ALL POWER MACHINERY

CHARLES B. REARICK — 30 CHURCH ST. — NEW YORK 7, N. Y.

BOILER

READY TO SHIP

SPECIAL VALUE & PRICE!!

1—270 HP ERIE CITY 3-drum low-head watertube. 160# pr.

LIKE NEW! USED LESS THAN 3 MOS. Good for 19,000 lb. steam/hr. at 200% rating.

A COMPLETE STEAM PLANT! incl. Peabody Oil Burners w/pre-heaters; Soot Blowers; Breeching; Stack; Pumps.

Now dismantled. For Immed. Delivery

From Our Brooklyn Warehouse

J. PARKER THOMPSON CO., Inc.

507 5th Ave., New York, N.Y. MU. 7-6547

MOTORS - M.G. SETS - CONTROLS

NEW AND GUARANTEED REBUILT

SYNCHRONOUS

HP	RPM	Volts	Mfg.	Type
1400	1200	440	Whse.	100%
720	900	2300	Whse.	100%
600	1800	2300	G.E.	100%
400	900	2300	Whse.	80%
250	200	440	G.E.	85%
200	900	400	E-M	80%
150	600	400	G.E.	100%
150	900	2300	G.E.	100%

SLIP RING

HP	RPM	Volts	Mfg.
700	514	2300	G.E.
500	1200	220/440	Elliott (new)
350	450	2300	Whse.
200	450	2300	Burke
100	1160	440	G.E.
75	720	220	G.E.
50	720	220	Whse.
40	900	220	G.E.

NEW DIRECT CURRENT

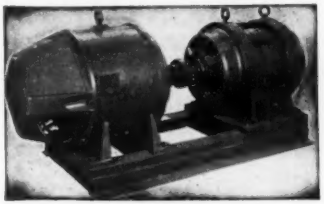
230 volt-dripproof

Qu.	HP	RPM	Mfg.	Frame
10	5	850/1700	G.E.	CD-66
3	7½	575/1725	G.E.	CD-77
1	7½	1750	Rel. (TE)	14T
1	10	575/2300	L.A.	4051

CRADLE TYPE DYNAMOMETERS

1—225 HP, Whse., 250 v. D.C., 300/2000 RPM, complete with Toledo automatic printing type scale and all necessary control.

1—150 HP, Whse., 275 v. D.C., 3000/4000 RPM, Frame 121, complete with all necessary control.



M-G SETS

KW	D.C. Volts	A.C. Volts	Mfg.
500	125/250	2300	Whse.
400	125/250	2300	Whse.
250	240	2300	G.E.
150	250	440	Whse.
100	275	2300	Whse.
50	250	440	G.E.
40	250	220/440	G.E.
30	125/250	2300/4000	G.E.
15	230	220/440	G.E.
7½VS	250	220/440	Rel.
3VS	250	220/440	Rel.

NEW MAGNETIC SLIP RING CONTROL

1—ALLIS 250 HP, 440 volt (125 HP, 220 volt) Reversing, 7 accel. steps, main line air ckt. brkr., fully magnetic, open or enclosed.

230 V. DIRECT CURRENT

Reconditioned & Guaranteed

HP	RPM	Mfg.	Brgs.
250	275/690	Whse.	Ped.
100	450/1350	Whse.	Sl.
65	400/1200	Rel.	Sl.
50	300/900	G.E.	Sl.
50	500/1500	G.E.	Sl.
40	400/1200	Rel. (TE)	Ball
35	400/1200	Ideal	Sl.
30	250/1000	Whse.	S.Sl.
30	350/1050	Whse.	Sl.
30	500/1500	Rel.	Ball
30	600	Whse.	Sl.
25	500/1500	C-W	Ball
25	600/1350	Rel.	Ball
25	690	Rel.	Ball
20	250/1000	Whse	Sl.
20	300/1200	Rel.	Ball
20	500/1500	G.E.	Sl.
15	250/1000	G.E.	Sl.
15	400/1600	Whse.	Sl.
15	575/1725	L.A.	Ball
15	650/1650	G.E.	Sl.
15	700/1350	Rel.	Ball
10	300/1200	Whse.	Sl.
10	400/1600	Whse.	Sl.
10	600/1200	Rel. (TE)	Ball
10	850	Rel.	Ball
7½	200/1200	Whse. (TE)	Ball
7½	300/900	G.E.	Ball
7½	400/1600	Rel.	Sl.
7½	400/1600	Whse.	Ball
7½	600/1800	Rel. (TE)	Ball
7½	1150	G.E.	Sl.
5	400/1200	C-W	Sl.
3	850/1700	Rel.	Ball

Buy from BOSWICK with confidence

WAlbridge 1195

BOSWICK ELECTRIC CO.

P.O. BOX 55 AKRON 9, OHIO

Immediate Delivery in All Types of

BOILERS

Bought • Sold • Rented

We own and offer the following types of equipment now located at our warehouse:

1—50 H.P., 150 lb. Clayton Package Boiler

Erie City Economics—125, 170, and 200 H.P.

Fire Box Boilers—165 H.P.

Package Type Boilers—18, 30, and 100 H.P.

2 New Frederick Stokers—2500 lbs. of coal/hr.

BOILER & EQUIPMENT CO.

743 Bedford Ave. Brooklyn 5, N. Y.
ULster 5-3588

---

500 KW GE SYNCHRONOUS CONVERTERS (3)

HCC6—Steel Frame—1200 RPM Ped. 220/280 V. DC Booster Type—Six Ph. Manual Controls Transformers to suit.

S. M. DAVIS

510 LASALLE ST. ST. LOUIS 4, MO.

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375 KVA - FOR SALE - 300 KW

WORTHINGTON-WESTINGHOUSE

INSTALLATION

COMMERCIALLY UNUSED

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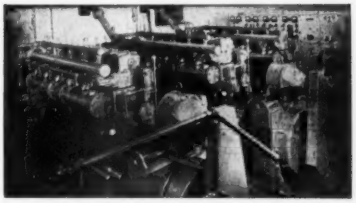
IMMEDIATE DELIVERY



Each Plant consists of

3 Worthington Model BB 5—150 HP Diesel Engine Generating Units direct connected to Westinghouse Generators.

Rated 100 KW—125 KVA—3 phase, 60 cycle, 460 Volts, AC Current at 600 RPM.

Suitable for reconnection to 85 KW—3/50/230/400 at 500 RPM.

Complete with all accessories and auxiliaries including evaporative coolers—switchboard—distribution panel.

OWNED & OFFERED BY

KANE-McGUIRE COMPANY

Single units available

1492 East 32nd Street
Brooklyn, New York
PHONE: WHitehall 3-6843

BREW-WOLTMAN OFFERS

TURBINE UNITS

1—15630 KVA G.E. Cond. 60 cy. 13200 V. 275-lb.
1—10000 KVA G.E. Cond. 25 cy. 6600 V. 200-lb.
1— 6250 KVA Allis Cond. 60 cy. 4000 V. 175-200 lb.
1— 5000 KVA West. Cond. Extr. 60 cy. 480 V. 385-lb.
1— 3750 KVA G.E. Cond. 60 cy. 2300 V. 185-lb.
1— 2500 KVA Worthington Non-C. 60 cy. 2300 V. 150-200 lb. 40-lb. BP
1— 2500 KVA G.E. Extr. Cond. 60 cy. 480 V. 185-200 lb. Steel Valve Chest
1— 2500 KVA G.E. Cond. 60 cy. 600 V. 175-lb.
1— 1875 KVA West. Cond. 60 cy. 2300 V. 170-lb.
1— 1875 KVA G.E. Cond. 60 cy. 2300 V. 180-lb.
1— 1563 KVA G.E. Extr. Cond. 60 cy. 2300 V. 200-lb.
1— 1250 KVA Allis Cond. 60 cy. 2300 V. 150-200 lb.
1— 938 KVA G.E. Extr. Cond. 60 cy. 240 V. 200-lb.
1— 938 KVA West. Extr. Cond. 60 cy. 2300/4100 V. 200-lb.
1— 750 KVA G.E. Extr. Cond. 60 cy. 480 V. 200-lb.
1— 750 KVA G.E. Cond. 60 cy. 2300 V. 150-lb.
1— 625 KVA West. Cond. 60 480 V. 150-lb.
2— 250 KVA Elliott Non-C. 60 cy. 208 V. 200-lb. 5-lb. BP

DIESEL ENGINE UNITS

2—1700 HP Gen. Motors 2300 V. 60 cy.
1—1600 HP Fair. Morse 2300/4150 V. 60 cy.
1— 600 HP Enterprise 440 V. 60 cy.
2— 500 HP Winton 2400 V. 60 cy.
1— 250 HP Buckeye 240 V. 60 cy.

STEAM ENGINE UNITS

1—625 KVA Ames Vertical Uniflow 2300 V.
1—250 KVA Ames Vertical Uniflow 480 V.
2—187 KVA Ames Vertical Uniflow 240/480 V.
1—156 KVA Ames Vertical Uniflow 240 V.

ROTARIES — 60 CY.

QU.	KW	MFR.	VOLTS-DC	TRANS.	RPM
1	3250	G.E.	225/285	13800	300
1	1500	G.E.	600	4150	600
3	1000	G.E.	660	13200	900 Auto.

SYNCHRONOUS CONDENSERS

QU.	KVA	MFR.	VOLTAGE	RPM
1	7500	G.E.	13800	720
1	2500	West	2400/4160	900
1	2000	West.	2300	720
1	1500	G.E.	4600	900
1	1500	West.	2300	900

MOTOR GENERATOR SETS — 60 CY.

QU.	KW	MFR.	VOLTS-DC	A.C.	RPM
1	2000	G.E.	660	4000	450
1	1500	G.E.	600	4150	600
2	1000	West.	660	4150	900
1	500	West.	125	2300	720
1	200	West.	275	2200	900
2	150	G.E.	250	2300	1200
1	150	West.	275	440	900
1	75	West.	125	440	1200

SYNCHRONOUS MOTORS — 60 CY.

QU.	HP	MFR.	VOLTAGE	RPM
1	4350	Cr. Wh.	13800	514
2	700	West.	2300	200
1	600	G.E.	2300	1800
1	600	G.E.	440	360
1	300	G.E.	2300	600
1	300	West.	2300	900
1	250	Cr. Wh.	440	300
1	115	West.	440	1200

FREQUENCY CHANGERS

QU.	KVA	MFR.	CYCLES	RPM
1	3125	G.E.	25/60	300
1	3000	G.E.	60/25	300
1	2500	G.E.	25/62½	750
1	1700	West.	60/24	720
1	1250	G.E.	25/60	300

OIL CIRCUIT BREAKERS — OUTDOOR

1— 600 A. 73 KV G.E. FHKO-236-500
1— 400 A. 37 KV G.E. FHKO-136-350
1— 400 A. 37 KV G.E. FHKO-236-500
4— 600 A. 15 KV G.E. FHKO-139-750
2— 600 A. 15 KV G.E. FHKO-136-1328 BS
1—1200 A. 15 KV G.E. FKO-139-350
1— 600 A. 15 KV G.E. FKO-139-350
2— 600 A. 15 KV G.E. FLO-15-250

MERCURY ARC RECTIFIERS

QU.	KW	KIND	DC VOLTS	TRANS.
2	4500	Multi Anode	600	13800
1	1000	Multi Anode	600	13800

TRANSFORMERS

3— 3333 KVA West. 132000—7620/13200 Y
3— 75 KVA A.C. 66000-24000—7200/12470 Y
1— 2500 KVA G.E. 59 73 KV—5 taps, 3 ph.
4— 2500 KVA West. 44000—11000
4— 1000 KVA West. 44000—11000
3— 150 KVA G.E. 44000—700/12470
3— 100 KVA Wag. 44000—7200
3— 100 KVA G.E. 44000—2300
3— 75 KVA West. 44000—7200/12470 Y
3— 8333 KVA West. 43800—13900
3— 100 KVA Wag. 36000—7200/12470 Y
1—18750 KVA A.B.B. 34840—11000, 3 ph.
3— 150 KVA Wag. 33000—7200/12470 Y
3— 100 KVA A.C. 33000—7200/12470 Y
3— 100 KVA West. 33000—240/480 NEW
3— 75 KVA Wag. 33000—7200/12470 Y
4— 450 KVA A.C. 25410/44000—13280/23000
3— 1250 KVA G.E. 23000—2300/4000
3— 800 KVA G.E. 22000—2300
3— 100 KVA G.E. 22000—7200/12470 Y
9— 50 KVA G.E. 22000—2300
4— 750 KVA Wag. 19050/33000 Y—6900/11950
6— 200 KVA G.E. 13200—2300
2— 200 KVA G.E. 11500—220/110
3— 200 KVA Mol. 11000—2300
3— 250 KVA Pitts. 7200—220/440
3— 100 KVA West. 7200/12470 Y—2400
4— 50 KVA G.E. 7200/12470 Y—2300
3— 500 KVA Pitts. 6900/11900—550
3— 333 KVA Pitts. 6900/11900—550
3— 150 KVA Wag. 6900—2300
4— 100 KVA G.E. 6900/11900—2400
3— 37½ KVA G.E. 6900/11900—2400
2— 150 KVA West. 4800/8315 Y—480
3— 333 KVA G.E. 2300—230/460
1— 100 KVA G.E. 2300—575, 3 ph.
3— 100 KVA West. 2300—230/460
3— 75 KVA Mol. 2400—120/240
6— 50 KVA West. 2400—115/230 DRY TYPE
3— 15 KVA Stand. 450-225—117

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2—4000 KW, 2300 V., 150# Cond.
1—3500 KW, 4000 V., 150# Cond.
1—3000 KW, 4000 V., 150# Cond.
1—2500 KW, 480 V., 150# Cond.
1—2500 KW, 550 V., 250# Cond.
1—2000 KW, 550 V., 175# Cond.
1—1500 KW, 2300 V., 200# Cond.
1—1250 KW, 2300 V., 250# Extr.
2—1250 KW, 2300 V., 225# Cond.
1—1000 KW, 2300 V., 175# Extr.
1—1000 KW, 2300 V., 250# Cond.
1—1000 KW, 4150 V., 280# N.C.
2—1000 KW, 480 V., 150# Cond.
1— 750 KW, 550 V., 170# Extr.
1— 500 KW, 2300 V., 185# Cond.
1— 300 KW, 2300 V., 150# Cond.

DIESEL GENERATORS

1—1000 KVA, 2400 V.
1— 700 KW, 480 V.
3— 540 KW, 480 V.
1— 437 KW, 480 V.
1— 200 KW, 480 V.

FIRE PUMP

1—New 1000 G.P. Turbine Driven

BOILERS

1—1,000 HP, 250#
3— 500 HP, 200#
1— 438 HP, 200#
2— 300 HP, 250#
2— 250 HP, 200#
4— 150 HP, 150# Se. Mr.
1— 78" H.R.T., 200#

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3—1250 KVA., G.E., 23000—2300/4000Y.
3—1000 KVA., Westgh., 11000—2400.
3— 333 KVA., G.E., 2300—230/460.
9— 200 KVA., G.E., 13200—2300.
3— 100 KVA., G.E., 44000—2300/4000Y.
2— 75 KVA, G.E., 4160/7200Y—120/240
3—37½ KVA., G.E., 13800—230/115.
2— 30 KVA., G.E., 2200—122/116/110.
1— 25 KVA., Westgh., 33000—2300.

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KW	MAKE	RPM	D.C.	A.C.
750	Al. Ch.	720	250	2300
500	West. Rotary	1200	250	2300
400	West.	720	550	2300
300	GE	1200	250	2300
300	G.E. Rotary	600	250	2300
300 (2)	West.	1200	250	2300
300 (2)	Al. Ch. Rotary	1200	250	2300
300	West.	1200	550	2300
200	G. E.	1200	250	2300
200	West.	1200	250	2300
200	Ridg.	900	250	2300
150	G. E.	1200	250	2300
150	GE.	900	550	2300
150	West.	1200	250	2300
100	Ridg.	1230	250	2300
50	R. P.	1200	250	2300
35	G.E.	1750	125	220/440

A.C. MOTORS

HP	MAKE	RPM	TYPE
400	GE	450	Sl.Rg.
300	GE	450	Sl.Rg.
150	GE	600	Syn.
100	West.	900	Syn.
100	West.	1200	Sq.Cg.
100 (2)	GE	1750	Sq.Cg.
100 (2)	GE	450	Sl.Rg.
75	West.	900	Sq.Cg.
60	West.	600	Sl.Rg.
50	GE	1750	Sq.Cg.
40	GE	900	Sl.Rg.
40	West.	900	Sq.Cg.
30	G.E.	1200	Sq.Cg.

PLATING M-G SETS

3—1500/3000 Amp. 6/12 Volts—AC Syn Motors
1—1500/3000 Amp. 6/12 Volts—AC Sq.C. Motor
1—1000 Amp. 75 volt 75 KW—AC Sq.C. Motor

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400 & 250 HP 1200 RPM Ind. Motors

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IMMEDIATE DELIVERY AIR COMPRESSOR

876 cfm Chicago Pneumatic 100 lb. pressure 2300 or 440 v, A.C. syn. motor complete with starting equipment.

A.C. MOTORS

220/440 volt 3 ph. 60 cycle

HP	MAKE	RPM	TYPE
525	Elliott	720	Syn.
450	Elliott	720	Syn.
400	Westg.	600	CS
350	Westg.	585	CS
300	G.E.	1800	KT-563
250	G.E.	515	KF-TEFC
250	Burke	720	2300 v. Syn.
250	G.E.	1150	I
225	Elec. Mach.	1800	Syn.
200	G.E.	430	KF-TEFC
200	Westg.	291	(2300 v.) CS
200	G.E.	860	I
200	G.E.	1800	(2300 v.) Syn.
200 (2)	Wagner	1750	RP-2
200	Westg.	1750	CS-871C
150	G.E.	400	2300 or 220 v.
150	Cr. Wh.	860	QR
150	G.E.	1200	KT-563
150	G.E.	1200	4100 or 2200 v.
150 Vert.	G.E.	1775	KF-2300 v.
150	G.E.	1775	KF-5542
125 (7)	Wagner	1150	RP-26
125	Elec. Mach.	164	Syn.
125	Cr. Wh.	720	
100 (5)	Wagner	860	RP
100	Cr. Wh.	600	
100 (3)	Westg.	1750	CS-863
100 New	Reliance	1765	B-5084S BB

SLIP RING MOTORS

3 Phase — 60 Cycle

HP	MAKE	RPM	TYPE
60	G.E.	570	MTC-5346
75	G.E.	720	I-M
75	G.E.	600	I-M
75/150	Westg.	290/580	CW-1012
150	Westg.	1140	CW-873C
150	G.E.	600	I-M-16
300	Westg.	500	CW-1000
300	Cr. Wh.	290	(2200 volts)
400	Westinghouse	580	CW-39B (2300 volts)
400	Westg.	438	(2200 volts) 220/440

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DIESEL ENGINE GENERATOR SETS

4—100 KW., 120/240 V. D.C. Delco Generators dir. con. to 150 HP., Model GBD-3, 5½ x 7, 8 cyl., Superior Diesel Engines, elec. start, power panel, accessories. Practically new—only used for spares.

3—100 KW., 220/440 V. A.C. 3 ph. 60 cy. West. Gen. dir. con. to 150 HP. Superior Diesels same as above.

1—96 kva. Fairbanks Morse 220/440 V. 3 ph. 60 cy., 360 rpm. DIESEL.

10—37½ kva. 3 ph. 60 cy. 127/220 v. or 220/440 v. 1200 rpm., Century A. C. Generators with dir con. exciters driven by 70 HP., 4 cyl. Model UD-14 International Harvester DIESEL Engines with panels.

2—25 kva. 120 v. 1 ph. 60 cy. Westinghouse dir. con. to 58 HP., 4 cyl. 900 rpm., LeRoi Gasoline Engines with control panels.

3—25 kw., 220/440 v. 3 ph. 60 cy. Westinghouse direct connected to 4 cyl. LeRoi Gasoline valve in head liquid cooled Engine complete with control panels.

17-7½ kw., 120 v. 1 ph. 60 cy. Continental Gas Engines.

BARGAIN PLANER

1—Lincoln Bed 51" wide, 16 ft. long, four tool heads, 25 HP variable speed motor and control.

25 CYCLE MOTORS

220/440 v. 3 ph.

HP	MAKE	RPM	TYPE
150	G.E.	730	KT-563—2200 v.
125	Reliance	1450	AA-A685Z—BB
75	Westg.	480	M4—Hi-Torque
75	Westg.	675	CW-873C—Slipring
60	Westg.	715	CS
40	G.E.	1455	KT-337
35	Wagner	500	BP
30	Westg.	725	CS-W504 SP BB

25 CYCLE MOTORS (Cont.)

220/440 v. 3 ph.

HP	MAKE	RPM	TYPE
30	Reliance	1440	AA-445Z TE FC BB
20	Reliance	445	AA-C504 TE FC BB
20	Imperial	680	Frame 404 TE NV BB
20	Star	695	AHS-68 BB—Slipring
20	Reliance	1450	AA-B405 TE FC BB
15	Westg.	400	CS-364Y
15	Westg.	563	Frame 364Y
15	Reliance	710	AA-B-404 TE FC BB
15	G.E.	720	K-405 TE FC BB
15	Reliance	1450	Frame 74AA BB
15	Reliance	1450	Frame 119-AA FC BB

DC VARIABLE SPEED MOTORS

230 Volts

HP	MAKE	RPM	TYPE
400	All. Chal.	600/1200	
250	G.E.	500/1000	CDM-1650Y SPB₂₂
125	Westg.	125/500	RB Anti-Fric.
100	Westg.	500/1000	SP BB
75/150	G.E.	300/1200	CD-189 BB Encl.
75/100	Westg.	600/1200	SA-13L BB
50	G.E.	600/1200	LC
50	Reliance	400/1600	T-985F TEFC BB
50	Reliance	300/1200	T1985T BB
50	Crkr. Whlr.	300/1200	CMC-8B
40/50	Westg.	500/1500	SK-131 SP BB
40/50	Reliance	500/1500	T-461T BB
40	Westg.	750/1500	SK-140
40	All. Chal.	575/1150	E-145
40	Reliance	500/1500	T-461F TEFC BB
40	Reliance	400/1600	T-615F TEFC BB
40	El. Gen. Co.	385/1200	Frame 1808
35	G.E.	625/2100	COM-1829AE
35	G.E.	350/1400	BP-162 SS
30/40	Imperial	400/1600	D-D69 BB DP
30/40	Reliance	300/1200	T-651 TE BB
30	Westg.	1150/1750	SK-133 TEFC BB
30	Reliance	600/1200	T-262F TENV BB
30	Reliance	400/1600	T-461F TEFC BB
30	Imperial	400/1600	D-D68 BB DP
25	Reliance	400/1600	T-310F TEFC BB
25	G.E.	300/1200	CD-128
20/25	Reliance	400/1600	T-262T DPBB
20	Westg.	750/1500	SK-119-L
20	Westg.	625/1250	SA-6
20	Reliance	600/1200	T-131T BB
20	Westg.	565/1130	S-8
20	G.E.	500/1500	BF-11 SB
20	Reliance	400/1600	T-262T TEFC BB

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3—833 KVA Westinghouse transformers OISC, 1 ph., 2400/4160Y to 480 volt, Type SL, Ser. 2-150,000

1—200 HP, 600 RPM, GE, Slipring IM, Frame 17, 3/60/220/440

1—150 HP, 514 RPM, Westinghouse Slipring, Type HF, 3/60/220/440

1—200 HP, 600 RPM, EM, Synchronous 3/60/2200 type BRKT

1—125 HP, 600 RPM, EM, Synchronous 3/60/2200 type BRKT

1—200 KW MG set, 125 V. DC, 900 RPM Synchronous drive, 3/60/2300 E.C. Factory Set.

1 -24x24 Dayton Dowd C524, 16,500 GPM, 18.5/35 FT. HD., 360/450 RPM

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OPEN SLEEVE BEARING—3 PHASE—60 CYCLE

Qu.	H.P.	RPM	Volts	Make	Type	Frame	Qu.	H.P.	RPM	Volts	Make	Type	Frame
1	½	1200	550	West.	CW	W204	1	25	900	440	West.	CI	572A
1	½	1800	550	G.E.	MT	111	1	25	900	550	West.	CW	638A
1	1½	1200	220	G.E.	MT	140	1	25	1200	220	West.	CW	567C
1	1½	1200	220	West.	CW	166	1	30	1200	550	G.E.	MT	526
5	1½	1200	220	G.E.	MT	934	1	40	685	220/440	G.E.	MB	504
2	1½	1200	550	G.E.	MT	934	2	40	720	220	G.E.	MT	346
1	2	1200	220	Watson	KH5V		1	40	900	550	G.E.	MT	838
1	2	1200	220	West.	CW	232F	1	50	900	220	G.E.	IM	
1	2	1200	550	West.	CW	234C	1	50	900	550	West.	CI	638A
1	3	900	440	G.E.	MT	944	1	50	900	550	West.	HF	
1	3	1200	220	Clev. El.	MBW	2375	1	50	1200	440	G.E.	MT	536
1	5	850	220	West.	CW	446	2	60	900	2200	G.E.	MT	346
1	5	900	220	G.E.	MT	952	1	75	900	ANY	G.E.	MT	535
1	5	1200	220	Watson			1	100	685	550	A.C.	ANY	204C
1	7½	340	220/440	G.E.	KE	4052	1	100	1200	ANY	G.E.	MT	535
1	11	900	550	G.E.	ITC	Form M							
1	15	845	440	G.E.	MT	512							
1	15	1200	220	Wagner	15AVRS								

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Ingersoll Rand 7x7 Class ERI—100#—with or without drive.

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33 KW Gen. Elect. Type BR. Form C 60 V. DC. Direct connected to 50 HP 3/60/440/1800 Gen. Elect. Motor.

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1—600 HP Farrel-Birmingham Herringbone Gear Unit. Type SL. Size 30/16 Speed 730 RPM to 115 RPM.

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1—400 HP Nuttall (Westinghouse) Type LMR-25 Single Helical Heavy Duty Reducer—6-1 Ratio at 900 RPM with High Speed Shaft Extension for Brake.

400 HP SYNCH. MOTOR

1—400 HP Westinghouse Synchronous Motor. 3/60/2300/900 RPM. Unity P.F. with direct connected exciter—Late Type.

MOTORS

60-50-25 Cycle in Stock—All Sizes. Slipring—Squirrel Cage—Synchronous. All types of Control Equipment.

100 HP Westinghouse Slipring 3 Bearing 3/60/220/440/435 RPM.

100 HP Gen. Electric Type I form K 3/60/2300/600 RPM.

100 HP Gen. Electric Type KT 356 3/60/2200/900 RPM.

125 HP Gen. Electric Type I form K 3/60/440/720 RPM.

125 HP Gen. Electric Type KT 3/60/2300/1200 RPM.

150 HP Gen. Electric Type KT 3/60/440/500 RPM.

150 HP Gen. Electric Type I form K 3/60/2300/720 RPM.

150 HP Gen. Electric Type I form K 3/60/2300/900 RPM.

200 HP Gen. Electric Slipring Type I form M 3/60/440/600 RPM.

200 HP Gen. Electric Type KT 3/60/440/600 RPM.

250 HP Gen. Electric Type KT 3/60/440/720 RPM.

350 KW GENERATORS

2—350 KW General Electric Generators Type MPC, 250 Volt DC, 720 RPM Single Bearing Machines.

T.E.F.C. MOTORS

60 HP Westinghouse CS-607 3/60/440/900 X-Proof

50 HP Ideal New. 3/60/220/440/1800

2—20 HP Louis Allis ES. 365 3/60/220/440/1800 X-Proof

15 HP Louis Allis EX-364 3/60/220/440/1800 X-Proof.

DC CIRCUIT BREAKERS

1—1000 AMP. Condit. 2 Pole

1—1600 AMP. Condit. 2 Pole

1—1600 AMP. Westinghouse 2 Pole

1—3000 AMP. Westinghouse 2 Pole

125 VOLT DC MOTORS

1—100 HP Crocker Wheeler 125 Volt DC 850 RPM Ball Bearing

1—150 HP Crocker Wheel 125 Volt DC 850 RPM Ball Bearing.

Will make 1200 RPM 125 Volt Generators.

REBUILT TRANSFORMERS

3—100 KVA G.E. 1 ph., 60 cy. 2400/4160 pri. 120/240 sec.

3—1667 KVA Wagner 1 ph., 25 cy., 23,000 pri., 575 sec.

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6—10,000 KVA, 95,000/165,000 volts to 11,000 volts, Westinghouse single phase, Transformers.

3—600 KVA, 66,000 6,900 volt, single phase, G.E.

3—200 KVA, 66,000 2300/4000 volt single phase G.E.

1—600 Amp. Westinghouse type G-22, 154,000 volt, 3 pole Circuit Breaker.

2—400 Amp. Westinghouse type G-22, 154,000 volt, 3 pole Circuit Breakers.

6—2,000 Amp. Westinghouse CO-22, 15,000 volt, 3 pole Circuit Breakers.

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Diesel, Steam Turbine, Engine

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1000 KVA Elliott-DeLaverne
438 KVA (2) GE-Winton (Gen. Motors)
375 KVA (2) GE-DeLavrgne VO
375 KVA Fairbanks-Morse 32E14
353 KVA (2) Fairbanks-Morse 32D
312 KVA (2) Wghse.-Werthington
250 KVA Fairbanks-Morse 32E14
250 KVA GE-Buckeye, E-8
250 KVA Ideal-Buckeye, "80"
187 KVA GE-Buckeye "80"
175 KVA Fairbanks-Morse 32E14
125 KVA Ideal-Buckeye "E"
125 KVA (2) GE—Hercules
94 KVA Elec. Mchy.-Buda-8
90 KVA Fairbanks-Morse 32E14
75 KVA (2) General Motors (package)
62 KVA International Harves. (package)
50 KVA (2) Fairbanks-Morse 42F
350 HP Buckeye "80" (belted)
300 HP Buckeye "0" (belted)
240 Buda "HDC-6" (belted)
225 HP Buckeye (belted)
180 HP Fairbanks-Morse (belted)
154 Buckeye "80" (belted)
128 HP (4) Caterpillar (belted)
120 HP Fairbanks-Morse 32E (belted)

GAS ENGINE UNITS

750 KVA Elec. Machy.—800 HP Werthington

BOILERS

309 HP Combustion 3 dr. 160#
285 HP B&W 3 dr. 250#
255 HP (2) Combustion 200#
Three 250 HP HRT 150#

TURBO GENERATOR UNITS

1250 KVA GE 3/60/480 v; bleeder
937 KVA Elliott 3/60/2300 V. Cond.
625 KVA Elliott 3/60/2300 V. Cond.
625 KVA Al. Chal. 3/60/480 V.—Elliott, non-cond.
300 KVA Al. Chal. 3/60/480 V.—Elliott, non-cond.
300 KW Elliot, 250 v. DC—non-cond.
375 KVA GE 3/60/480-240 v. (Bleeder)
250 KVA GE 3/60/600 v; non-cond.
250 KVA Al. Chal. 3/60/480 V. Elliott, non-cond.
250 KVA Elliott 3/60/480 V. Elliott, non-cond.
187 KVA GE 3/60/480 v; non-cond. 375#
125 KVA GE 3/60/600 V. non-cond.
125 KVA Wghse. 3/60/240/480 V.—Murray, non-cond.
62 KVA GE 3/60/240/480 V. Non-cond.
20 KVA GE 3/60/240/480 V.—Terry, non-cond.

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New York, N. Y.

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HEMPHILL GUARANTEED EQUIPMENT

GUARANTEED GOOD BECAUSE REBUILT AND TESTED BY HEMPHILL ELECTRICAL ENGINEERS

TRANSFORMERS—60 Cycle

Qu.	KVA	Make	Type	Ph.	Voltages
1	1500	GE	Pyranol	3	4150x2400
1	500	Kuhl.	ODSC	1	4600x2300
1	333	GE	ODSC	1	13200x220/440
1	200	GE	HT	3	2300x220
1	200	Pitts.	ODSC	1	4000x110/220
1	200	Mol.	C	1	2300x220/440
3	100	WagnerHEB		1	2400x120/240
1	100	Amer.		1	15000x2300
3	100	GE	Auto	1	4150Yx2400Y
9	50	GE	H	1	13750x13750x216Y
1	50	Al. Ch.	ODSC	1	4550x120/240
2	50	Pitts.	Sub	1	4550x120/240
1	50	Amer.	ODSC	1	6600/13200x220/440
1	50	Amer.	WF	1	2400x240/50
1	50	GE	KS	1	2300x230
1	50	Amer.	AT	1	220x220/44
1	37½	GE	H	1	2200x110/220
1	37½	Amer.	RS	1	6900/13800x220/440
1	37½	Amer.	OISCID	1	6600/13200x220/440
2	37½	Amer.	AT	1	220x220/44

MOTOR GENERATOR SETS

Qu.	KW	Make	Speed	DC	AC
2	1000	GE	514	600	2300-4150 3ph.
1	200	Whse.	900	250	220-440 3ph.

1	150	GE	1200	125/250	2300 3ph.
1	150	Whse.	600	125	4150 3ph.
1	125	CW	1200	125	220-440 3C
1	100	El. Mach.	1200	125	4150 3ph.
1	100	GE	900	250	2300 3ph.
1	95	GE	1200	60	440 3C
1	93	GE	1200	60	4150 3ph.

SYNCHRONOUS MOTORS

Qu.	H.P.	Make	Speed	Type	Volts
1	300	El. Mach.	720	TEFC	2200
1	150	GE	720	ATI	2300
1	150	GE	1800	TS	220
1	150	Whse.	900		220

SLIP RING MOTORS

Qu.	H.P.	Make	Speed	Type	Volts
1	250	Whse.	600	CW	440
1	200	GE	1800	MT	2300

SPECIAL—WELDING

1—150 KVA GE, type KWC, 1 ph., 550 V. sec. 12.22 6.05 V. Thryatron Spot and Seam, Control CR 7503

1	200	Whse.	600	CW	440
1	200	GE	600	MT	440
1	100	GE	400	IM	440
1	75	GE	1200	MT Vert.	220
1	60	GE	1750	MT	220
1	60	GE	900	MT	440
1	50	GE	1720	MT	220
1	50	Whse.	900	CW	220
1	50	GE	1700	MT	220
1	50	GE	600	MT	220
1	40	GE	1200	MT	220

SPECIAL M.G., A.C. WELDER

1—176 KVA Whse., 220 V, 57 PF, 1200 RPM, 1 ph., with 75 HP Slip Ring, 440V, type CW, Exc. & Control

Member of the National Industrial Service Assn., Inc.

Member of the American Rebuilders Association

Member Body of the American Standards Association

"FOR POWER"

J.L. HEMPHILL & CO.

1604 53rd STREET, NORTH BERGEN, N. J.

PHONE NEW YORK—LONGACRE 5-3227

PHONE NEW JERSEY—UNION 3-2600

TURBO-GENERATORS

AVAILABLE IMMEDIATELY

1 6250 kva 5000 kw 3600 rpm Allis-Chalmers 200 lbs. 100° SH condensing. Will operate 275 lbs. 615° TT without change. Generator 3/60/11500 can be changed to 2400/4160 V. Complete auxiliaries—can be operated for inspection. Checked by factory engineer in September 1951—no repairs required.

1 1875 kva 1500 kw 3600 rpm General Electric 150 lbs. 0° SH condensing. Generator 3/60/2300.

1 1567 kva 1250 kw 3600 rpm Allis-Chalmers 140 lbs. condensing. Will operate 200 lbs. 450° TT without change. Generator 3/60/2300. Complete auxiliaries.

1 1250 kva 1000 kw 3600 rpm Westinghouse 185 lbs. 100° SH condensing. 3/60/2300. Completely reworked, generator has new winding. Complete auxiliaries.

1 937 kva 750 kw 3600 rpm General Electric 150 lbs. condensing. Generator 3/60/2300.

1 625 kva 500 kw 3600 rpm Westinghouse 150 lbs. 100° SH non-condensing. Generator 3/60/240.

1 625 kva 500 kw DeLaval geared 5000/900 rpm 150 lbs. condensing. Generator 3/60/2300. Can operate 275 kw 10 lbs. BP without change.

1 187½ kva 150 kw Westinghouse geared 7200/900 rpm 150 lbs. 100° SH non-condensing. Generator 3/60/240.

ALSO IN OUR STOCK

COMPENSATORS, A.C. AUTOMATIC

75 hp 3/60/2300 Cutler Hammer Bul. 9622 w/current limit. fuses. New

125 hp 3/60/2200 G.E. CR7051-H1A.

COMPENSATORS, A.C. MANUAL

100 hp 3/60/220 Allis-Chalmers Type RMC

100 hp 3/60/2200 Westinghouse Type A

CONDENSERS

2—725 sq. ft. C. H. Wheeler 2 pass surface. New

COMPRESSORS, AIR

1200 CFM @ 200 rpm I-R 2 stage 22"x14"x16" short center belt drive.

1000 CFM @ 225 rpm CP 2 stage 20"x12"x14" short center belt drive.

DIESEL GENERATORS

250 kw 400 rpm 3/60/220-440-2200 Superior YLO

ENGINE GENERATORS

2—65 kva 327 rpm 3/60/220 Engberg 9x10 vertical 175 lbs. non-condensing.

GASOLINE ENGINE GENERATORS

50 kw 1800 rpm 3/60/220 Waukesha-Hardee housed on wheels.

GENERATORS, A.C.

375 kva 225 rpm 3/60/220 Allis-Chalmers engine type

250 kw 400 rpm 3/60/220-440-2300 GE engine type

250 kw 1800 rpm 3/60/2200 Westinghouse ped. brgs.

200 kw 720 rpm 3/60 any voltage GE ped. brgs.

GENERATORS, D.C.

75 kw 1200 rpm 125 V. GE single brg.

20 kw 1200 rpm 125 V. GE CDM

OIL CIRCUIT BREAKERS

600 amp. 15000 V. West. FO221 o/d solenoid oper.

600 amps. 15000 V. Condit 501 o/d solenoid oper.

MOTORS, SLIP RING

350 hp 360 rpm 3/60/2200 GE Type IM

200 hp 1800 rpm 3/60/2200 GE Type IE 13B

200 hp 1800 rpm 3/60/440 GE Type IM

100 hp 900 rpm 3/60/440 GE Type MTC5346

75 hp 1800 rpm 3/60/2200 Westinghouse C.W.

2— 75 hp 720 rpm 3/60/2200 Westinghouse HF

50 hp 720 rpm 3/60/2200 GE Type MT552

50 hp 900 rpm 3/60/2200 GE Type IM

MOTORS, SQUIRREL CAGE

125 hp 3600 rpm 3/60/2200 GE Type FT

100 hp 1800 rpm 3/60/2200 A-C Type AR

60 hp 1800 rpm 3/60/220-440 F-M Type H

50 hp 720 rpm 3/60/2200 GE Type KT546

MOTORS, SYNCHRONOUS

400 hp 1800 rpm 3/60/2200 Westinghouse ped. brgs.

300 hp 600 rpm 3/60/220-440-2200 GE engine type

290 hp 720 rpm 3/60 any V. GE Type ATI ped. brgs.

100 hp 1200 rpm 3/60/2200 West. dir. conn. exciter

MOTOR-GENERATOR SETS

1000 kw 600 V. 514 rpm Westinghouse 1440 hp any voltage syn. motor

PUMPS, BOILER FEED

750 gpm 450 lbs. 3600 rpm Goulds 3360 4"—4 stage

475 gpm 750 lbs. 3600 rpm Goulds 3360 3"—6 stage

2—150 gpm 230 lbs. 2750 rpm Frederick steam turbine driven

TRANSFORMERS, 60 CYCLES

2—1000 kva 13800/2300 V. 1 Ph. GE Type H Form VDDJ

3—75 kva 2400-4160/240-480 V. 1 Ph. GE Type H Form KF

3—37½ kva 2400-4160/120-240 V. 1 Ph. GE Type H Form K

131—10 kva 2400-4160/120-240 V. 1 Ph. Various Makes—All modern

28—7½ kva 2400-4160/120-240 V. 1 Ph. Various Makes—All modern

TAMPA ARMATURE WORKS INC.

401 S. MORGAN ST. PHONE 2-1966 TAMPA, FLORIDA

MOTORS—M. G. SETS—TRANSFORMERS

SQUIRREL CAGE MOTORS
3-Ph., 60-Cy.

Qu	HP	Make	Type	Volts	RPM
1	400	Cont.	NZ-806	2300	1200
1	400	G.E.	IK	2200	514
1	400	G.E.	KT-412	2200	435
2	300	Wise.	CS-896	2300	1780
1	250	Wise.	CS-873C	2200	1160
1	200	Al.Ch.	AR	440/220	1580
2	125	Al.Ch.	AR	2200	1750
1	125	Wise.	CS-761C	440/220	1750
1	125	C.W.	126-J	440/220	430
2	100	Wise.	CS-663C	440/220	1750
1	100	Al.Ch.	AR	550	690
1	100	F.M.	H241B	440/220	435
1	100	Wise.	CS-938	2200	495
1	75	G.E.	I-K15	440/220	570
1	75	Al.Ch.	AR	2200	1765
1	75	Al.Ch.	AR	2200	1750
1	75	Al.Ch.	AR	2200	690

SYNCHRONOUS MOTORS
3-Ph., 60-Cy.

Qu	HP	Make	PF	Volts	RPM
1	3000	Wise.	80	4800/2400	720
2	2100	G.E.	100	2300	360
2	1750	G.E.	100	2300	3600
1	750	G.E.	80	2300	450
1	187	G.E.	80	220/440	720
1	150	G.E.	100	2200	900
1	150	G.E.	100	550/2200	600
1	150	G.E.	80	550/2200	450
3	135	G.E.	80	4000/2200	1200
1	125	El.Mchy.	100	4800/2400	900
1	125	G.E.	80	2200	900
2	100	Wise.	80	440/220	1800
1	100	Wise.	100	2200	1200
1	100	Ideal	80	220/440	900
2	100	G.E.	80	220/440	600
1	60	G.E.	80	220/440	1200
2	50	G.E.	80	2200	600

SLIP RING MOTORS—CONSTANT DUTY—3-Ph., 60-Cy.

Qu	HP	Make	Type	Volts	RPM
1**	1200	C.W.	SR	2200	237
2**	1000	Al.Ch.	ANY	2200	235
1**	600	G.E.	MT-20	2200	360
2	500	G.E.	I-16-M	2300	450
1**	400	Al.Ch.	ANY	2200	514
2	400	G.E.	MT-412	2200	450
1	300	G.E.	I-15-M	2200	1200
1	300	Al.Ch.	ANY	2200	514
1	250	G.E.	MT-414	2200	300
1	200	G.E.	I-16-M	2200	585
1	180	G.E.	I-13-M	2200	1750
1***	125	Whse.	CW-870	2200	870
1	100	F.M.	H200C	440/220	900
1	75	G.E.	IM	440/220	695
1	75	Whse.	CW-7540	440/220	690
1	60	Whse.	CW	440/220	900
1	50	G.E.	MT-536	2200	1150
1	50	F.M.	SR	440/220	600
1	40	Al.Ch.	ANY	2200/440	435

** Mill type pedestal bearing. *** 3-Bearing

In our stock you will find manual and magnetic primary and secondary controls 10 to 3000 hs., which we can furnish complete for any requirements.

MOTOR GENERATOR SETS

Qu.	KW	Make	RPM	Volts DC	Volts AC
1	2400(3-U)	Al.Ch.	720	525	4800
1	2400(3-U)	Whse.	720	600	4800/2400
1	1000	G.E.	514	850	2300
2	500	C.W.	720	575	2300 440
1	500	C.W.	720	250/275	2300 440
1	500(3-U)	Whse.	1200	250	440
1	250	Whse.	1200	125/250	2300
1	200	Whse.	1200	125/250	2300 440
1	200	Ridgway	900	275	2200
1	155	G.E.	720	250	2300/440
1	150	G.E.	1200	500	2300/440
1	100	Al.Ch.	1200	125/250	4000/2300
1	100	Delco	1200	125/250	440/220
1	100	C.W.	1200	125	440/220
1	100	Ridgway	1200	275	4000/2300
1	85	C.W.	1200	250	4000/2300
1	75	Star	1200	230	440/220
1	75	Whse.	900	75	2200
1	75	Al.Ch.	900	250	2300
1	50	Burke	1750	250	440/220
1	35	Whse.	1750	250	440/220
1	25	Ideal	1750	125	220
3	20	Al.Ch.	1200	250	440/220

DIRECT CURRENT MOTORS

Qu	HP	Make	Type	RPM
1***	3000	Whse.	Encl.(Rev.)	600
1***	2400	Whse.	Encl.(Rev.)	600
4***	1500	Whse.	Encl.(Rev.)	600
4***	1200	Whse.	Encl.(Rev.)	600
4***	800	Whse.	Encl.(Rev.)	600
1	350	G.E.	CD-189-A	1150
1	200/4-0	El.Dy.	No. 22	400/1200
1	250	G.E.	MPC	325/975
1***	200	G.E.	MPC	500/1200
1	200	Whse.	Mill	300/1200
1	180	G.E.	MPC	400
1*	150	C.W.	83-H	890
1***	125	Whse.	SK-190	600
2	125	Whse.	SK-184	575/850
1	100	Rel.	1995-F	300/1200
2	100	Rel.	1050-T	400/1200
1	90/160	G.E.	MPC	625/1125

All above 230-VDC except where marked ***
*** Pedestal bearing mill design 525/600-VDC.
Rev. designed for mill reversing service.
* T.E.F.C.

We have in stock 100 magnetic panels which we can furnish arranged for your particular requirements.

FREQUENCY CONVERTER SETS

Qu	Make	
1	750-KVA Elec.Mchy.	440/3/60 to 440/3/180
2	1200-KW G.E.	2300/3/60 to 400/3/30
1	1700-KVA Whse.	2300/3/60 to 2500/3/24

The above complete with control panels and starting quipment.

TRANSFORMERS — Power

Qu	Make	KVA	Type	Phase	Voltage
1	G.E.	2760	DH	3	7300-6900-240/480
4	G.E.	333	H	1	13200/1100-2200
3	Packard	250	A	1	13200-2200
3	G.E.	100	H	1	33000-2300
3	Whse.	100	SS	1	12075/10955-330/460
3	Whse.	100	Auto	1	4160,2400-2400/1385
3	Al.Ch.	50	OISC	1	22000-220
2	Uptegraff	37½	HD	1	2300-115/230
2	Kuhlman	15	Dry	1	480-240
45(new)	Al.Ch.	5	OISC	1	2400-120/240

T. B. MAC CABE COMPANY

4314 CLARISSA STREET — Phone DAvenport 4-8300 — PHILADELPHIA 40, PENNA.

TURBO-GENERATORS

2000 K.W., 3 ph., 60 cy., 150 lbs G.E.
1000 K.W., 3 ph., 60 cy., 250 lbs G.E.
750 K.W., 3 ph., 60 cy., 200 lbs extract. G.E.
500 K.W., 3 ph., 60 cy., 150 lbs G.E.
150 K.W., 250 v. new Westgh., D.C.

DIESEL UNITS

62½ KVA., 3-60-220-440 v., Caterpillar
37½ KVA., 3-60-220 v., Ready Power
100 K.W., 250 v., D.C. Superior Delco

UNUSED PUMPS & MOTORS

Union Steam Co., pumps all 250 ft. head with new Louis Allis motors, 1750 rpm.
1—400 GPM, 50 HP motor
1—500 GPM, 75 HP motor
1—900 GPM, 100 HP motor

TRANSFORMERS

1—600 KVA., 3 ph., 13800 x 575
1—500 KVA., 3 ph., 11500 x 460
2—500 KVA., 13800 x 2300
7—100 KVA., Gen. Elec. 11000 x 2200 v.
3—100 KVA., Moloney 11400 x 2200 v.
4— 50 KVA., Gen. Elec. 11000 x 2300 v.
2— 50 KVA., Westgh. 13800 x 230—460 v.
100—Transformers late type pocket bushings 12000-11500 x 120-240

3 PH., MOTORS

425 HP., Gen. Elec. MT414Y, 392 rpm., Slip rg.
300 HP., Gen. Elec. 257 rpm., syn.
200 HP., Gen. Elec. IM,—585 rpm., Slip rg.
200 HP., Westgh. CW., 1750 rpm., Slip rg.
200 HP., Gen. Elec. IM., 435 rpm., Slip rg.
200 HP., Gen. Elec. KT559, 1150 rpm., Sq. cage
150 HP., Gen. Elec. IM., 1800 rpm., Slip rg.
150 HP., Gen. Elec. IM., 514 rpm., Slip rg.
100 HP., Gen. Elec. IM—570 rpm., Slip rg.
100 HP., Gen. Elec. IM—585 rpm.
100 HP., Westgh., 900 rpm., Syn.
100 HP., Gen. Elec. KT543, 1800 rpm., Sq. cage
100 HP., Elec. Mchy. 300 rpm., syn.

SUB STATION

2—400 amp., 3 pole 15000 volts FO24 Westgh. electrically operated breakers disconnects etc.

We carry a large stock of all kinds of direct current motors etc. What have you for sale? What do you need?

KEYSTONE POWER PLANT EQUIPMENT CO.
8403 Hegerman St. Phila. 36, Penna.

SPECIAL OFFERING — Immediate Delivery

2—150 H.P. D. M. Dillon Scotch Marine Boilers, 165# pressure, A.S.M.E., N. Y. Standard, Oil Fired, further specifications on request.

4—570 H.P. Babcock & Wilcox Boilers—Cross Drum, Sectional Headers, straight tubes—Built for 200# were insured and operating at 200# up to March First. Full particulars given upon request.

1—263 H.P. Babcock &Wilcox Boiler—Cross Drum, Sectional Headers, straight tubes—Built for 225#, installed 1937.—This boiler has a Fusion Welded Drum, 70,000#.

1—New & Unused AMESTEAM GENERATOR—size A-250—250 HP. at 150# for #5 oil or natural gas firing. Complete with accessories.

1—Combustion Engineering, Low Head Boiler, 400 H.P. at 185# built 1943, complete with Stoker, Forced and Induced Draft Fans, Stub Stack and other accessories. Used very little.

We handle Boilers of various sizes and varying pressures; also Turbo-Generators, Diesels, transformers, switchgear, compressors etc.

We buy entire power plants. What have you to offer?

HOWE BROTHERS 342 MADISON AVENUE NEW YORK 17, N. Y. MUrray Hill 2-8562

AMERICAN
SINCE 1902
COMPRESSORS
VACUUM PUMPS
ONE TRY TELLS YOU WHY
YOUR CHOICE:
American—Bury—Chicago—Curtis—Davey—Gardner Ingersoll—LeRoi—Penn—Schramm—Sullivan—Worthington

HEAR-HERE
American Rebuilts Are Best

AMERICAN AIR COMPRESSOR CORP.
Dell Ave., & 47th North Bergen, N. J.

MURPHY DIESELS

Priced to Sell

1—ME6 radiator cooled with clutch & stub shaft. Power unit. 150 HP—1200 R.P.M.
1 Set—20 groove B sheave—18" Dia. Ball Bearing mounted. 6" not mounted for above.
1—ME66 radiator cooled E M Generator—100 KW. 220/440/3/60, 1200 R.P.M.
1—ME4 radiator cooled E M Generator—60 KW. 220/440/3/60, 1200 R.P.M.

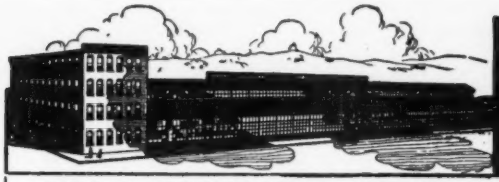
Immediately available
Can Be Inspected in Operation

MIDWEST UTILITIES POWER EQUIPMENT CORP.
1270 W. Augusta Blvd., Chicago 22, Ill.
ALL PHONES—EVERGLADE 4-4511

SPRINGFIELD BOILERS

SEC. HEADER, STRAIGHT TUBES
1—432 HP. 225#, $25.00 per HP. Built 1943.
3—461 HP. 225#, $10.00 per HP. Built 1923.
ALL IN GOOD CONDITION.

S. M. DAVIS
510 LASALLE ST. ST. LOUIS 4, MO.



GLOW ELECTRIC CO.

927 HARRIET ST. CINCINNATI 3, OHIO
PHONE MAIN 3024

MEMBERS OF AMERICAN REBUILDERS ASSOCIATION, A MEMBER BODY OF AMERICAN STANDARDS ASSOCIATION

SQUIRREL CAGE, OPEN 3 PHASE MOTORS

HP	RPM	VOLTS	DESCRIPTION
750	900	6600	Westinghouse
350	3600	2200	Westinghouse
300	900	440	G.E.
125	3600	220/440	A-C
125	1800	2200	A-C
115	1200	440	G.E.
100	1800	2200	Westinghouse
100*	1200	2200	G.E.-KF544
100	720	440	Westgh. 3 Brg.
85	3600	2300	G.E.
60	3600	2200	G.E.
60	1800	2200	G.E.
60	1200	440	Westgh. CS
50	1800	220	Triumph
50	720	2200	Westinghouse
40	900	440	G.E.
40	720	440	G.E.
35	3600	220	G.E.-KT
35	600	440	G.E.
30	720	220	G.E.
30	514	440	Stanley
25	3600	220/440	L-A
25	1800	220	L-A-HD
25	1200	220	Century
25	900	440	G.E.
25	720	220	Westinghouse
25	600	440	G.E.
20	3600	440	A-C
20	1800	220/440	G.E.
20*	1800	220/440	Westhe
20	1200	440	A-C
20	900	440	A-C
20	600	220	G.E.
15	3600	220	G.E.
15	1800	220/440	G.E.
15	1200	220	Imperial
15	900	220	Howell
15	720	220/440	A-C
10	3600	220	R. & M.
10	1800	220	Westinghouse
10	1200	220	A-C
10	900	220	A-C
10	720	440	A-C

* New Motors

SPECIAL

NEW DIESEL

Murphy ME650—165 HP, 1200 RPM 6 cylinder, 5¾ bore, 6½ stroke, complete. Will furnish engine only or as AC or DC Engine-Generator Set.

SLIP RING MOTORS

HP	RPM	VOLTS	DESCRIPTION
300	1200	440	Westgh.-CW
300	720	2200	Al. Ch.
250	600	2200	G.E.-117B
250	300	2200	Al. Ch.
200	1800	440	Al. Ch.
150	1800	440	G.E.-MT
150	720	2200	Al. Ch.
125	900	550	Ideal
100	720	440	Al. Ch.
100	400	440	West. Elec. (GE)
75	600	440	Al. Ch.
75	360	550	G.E.
60	1800	220/440	Al. Ch.
60	900	2300	Burke
50	1200	220	F-M
50	900	2300	Ridgeway
50	720	440	Al. Ch.
45	1200	440	Westgh.
40	900	220	Al. Ch.

MOTOR GENERATOR SETS

D.C. OUTPUT KW	Voltage	Description	A.C. INPUT HP	RPM	Volts
750	500	Westgh.	1070	900	13200
600	250	Westgh. (2-300KW Gen.)	1200	1200	2300
400	250	Westgh.-G.E.	600	1200	220/440
300	250	G.E.	450	1200	2300
200	125	G.E.-Westgh.	300	720	2300
200	125	G.E. (25 cy.)	300	730	440
200	250	G.E.-Westgh.	300	1200	440
100	250	Westgh.	147	1200	4300
75	125	G.E.	115	1200	440
50	125	C-W	85	1800	440
47½	125	Al. Ch.	100	1200	2300
40	250	Westgh.-G.E.	60	1200	220/440
22	125	Al. Ch.	33½	900	220
20	115	G.E.-Al. Ch.	30	900	220
15	250	Al. Ch.-L.A.	25	1800	220/440
12½	230	Westgh.	19½	1800	220
10	250	Westgh.	15	1800	220/440
7½	125	Westgh.	10	1200	220
5	230	Westgh.	7½	1200	440
3	250	Reliance-G.E.	5	1800	220
1	115	G.E.	1½	1800	220/440

PLATING AND ANODIZING SETS

D.C. OUTPUT AMPS	VOLTS	RPM	DESCR.	HP	A.C. END VOLTS	DESCR.
7500/3750	6/12	270	Munning	60	440	West. CS Sq. Cage
4000	2 to 8	425	Jantz & Leist			
2400	40/80	1200	Westgh.	290	440	WH Sync.
1500	3 to 40	600				
1500/750	6/12	1200	Munning Loeb	15	440	GE—1 Cage
1000	60	1200	Century	100	440	Century Cage
1000	20	1200	Star. 1 Brg.	—	—	—
1000	6	1200	Wagner	—	—	—
680	11	900	Westgh.	15	440	W.H. BB.
600	50	900	E-M	40	440	A-C
600	30	1200	W-E	30	440	GE
600	30	900	G.E.	25	440	GE
500	40	1200	G.E.	30	440	GE-KT
500	12	1200	Ideal	10	220	GE-KT
500	6	GE	Rectifier	—	440	—
416	12	1200	HVW	7½	440	GE-KT
400	40	1800	Hobart	25	220/440	Hobart
208	62	1800	G.E.	20	220/440	GE-KT

MODERN EQUIPMENT

DIESELS
G-M 6-71 Twins. Excellent condition

DIESEL GENERATOR SETS
AC—75 KW—3/60/120-208V-1200 RPM. Cooper-Bessemer. Model-GAWD
40 KW—3/60/120-208V-720 RPM. Buda-Lanova. Model-6LD
DC—80 KW—100/300V-600/1800 RPM. Cummings. Model-HGD
60 KW—120V-1200 RPM. Buda. Model-6DCG
60 KW—120V-1200 RPM. Cummings. Model-HGD

MOTORS—DC
1500 HP—525V-600 RPM. Westinghouse
222 HP—230V-3050 RPM. Westinghouse

MOTORS—AC
6000 HP at 93⅓ Cycle 400 RPM or 3800 HP at 60 Cycle 257 RPM. GE

GENERATORS—DC
1200 KW—525V 750 RPM. Allis-Chalmers

TURBINE GENERATORS—DC
300 KW—240V. Compd. 1200 RPM. Cond. G-E
150 KW—120V. Shunt 1200 RPM. Cond. Westinghouse
60 KW—125V. 3600 RPM G-E Turbine. Elliot Type. CDM. 100 HP

TRANSFORMERS—AIR COOLED 60 CYCLE—1 PH
2500 KVA—Volts 14625/3100/345. G-E
2000 KVA—Volts 14100/3100 Westinghouse
1000 KVA—Volts 14000/2945/223. G-E & Westinghouse

AIR COMPRESSOR
2000 CFM. 3 stages. Driven by 450 HP Clark Bros. Diesel

BOILERS
3—Cleaver-Brooks. 2000 Pounds Steam Per Hour. Model OB-5M

ICE PLANTS (NEW)
2—22 Ton Capacity. Freon 12. Mfd. by Frick

STEAM TURBINES—NEW
1—110 HP. 250# Steam—10# Exh. Pressure. 1200 RPM. Sturtevant
10—56.5 HP. 300-475# Steam—10-15# Exh. Pressure. 1225-1600 RPM. Sturtevant

BLOWERS—AIR PUMP
3—Blowers. Roots-Connersville. Size 16x18. Serial No. 14862. Capacity 5000 CFM against 6# P.S.I. pressure or 3450 CFM when creating 20" HG. vacuum.
1—Air Pump. Ingersoll Rand Type FS546. 5500 CFM. Discharge pressure 24.22# ABS. Intake pressure 20.61# ABS with 125 HP motor—3/60/2300.
1—Air Pump. Ingersoll Rand, Type FS-548. 6690 CFM. Discharge pressure 20.86 ABS. Intake pressure 17.10 ABS with 150 HP. motor 3/60/2300.
1—Blower. Buffalo. Size 60. Type R with 150 HP motor 3/60/2200.
1—Blower. Roots Connersville. Size 20 x 45.
1—Blower. Wibraham-Green. Size 24½x49.

NEW PUSH BUTTON STARTERS
Ward Leonard Line Starters magnetic for AC motors. Rated 7½ HP at 440V, 5 HP at 230V, 3 HP at 110V.

HOISTS
10—15000# pull at 78 FPM, 3360# pull at 348 FPM and 2 Auxiliary Drums driven by Chrysler 28.35 HP gasoline engines (New).

WIRE ROPE SLINGS
Dia. from ⅝" to 2½", length from 10 ft. to 150 ft.

AIR-COOLERS
For 6000 HP G-E motors
1500 HP Westinghouse motors
1200 KW Allis-Chalmers generators

CONDENSERS—MOST ARE NEW

No.	Sq. Ft.	Make	Passes	Tubes
2—	8000	CH Wheeler	2	Brass ⅝"
1—	3300	Str. Wells	2	Alum. Brass ¾"
1—	1050	Conseco	2	CU. NI. ⅝"
15—	400	Allis-Chalm.	2	Brass ⅝"
5—	155	Conseco	2	Brass ¾"

AIR EJECTORS
1—Foster-Wheeler. DE 51 Class for 3800 Sq. Ft. condenser. (New).
1—C. H. Wheeler, 4H240

COOLERS—NEW
Also—Lube Oil. Size 10-54.

HEAT EXCHANGERS—NEW
GM-Harrison Rad. Div. Model #H.E. 2120-327.

AXIAL FLOW FANS—NEW
16000 CFM—3" S.P. 3/60/440, Sturtevant.
8000 CFM—3" S.P. 3/60/440, Buffalo.
6000 CFM—3" S.P. 3/60/440, American.
35000 CFM—1" S.P. 230V. D.C. Wing.

VAPOR COMPRESSORS
High Pressure Air Compressors.
Centrifuges.
Evaporators.
Soot Blowers.
Pumps—motor & turbine driven.
Oxygen Producing Plant.
Welding Electrodes.
Reduction Gears.
Motors—A.C. & D.C.
Generators.
Machine Tools.
Diesel Parts.

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EASTERN SCRAP & SALVAGE CORP.

65 MUIRHEID AVE. TRENTON, N. J.

TEL. 5-6349

ARRANGE FOR INSPECTION

SLIP RING MOTORS 3-Ph., 60 Cy.

HP	Volts	Make	Speed
500 (2)	2200	G.E.	900
500	2300	G.E.	450
450	440/220	Whse.	514
350	2200/440	G.E.	450
300	3280	G.E.	360
300	440	Whse.	3600
250	440/220	Whse.	600
250	2200/550	G.E.	450
250	550/440	G.E.	1200
250	440	G.E.	600
200	440	G.E.	450
188	4000/2300	G.E.	1800
150	440/220	G.E.	450
150	440/220	Whse.	600
150	440/220	Whse. (3)	1800
145	4000/2300	G.E.	1800
125	2200/440	G.E.	600
125	550/440	G.E.	1200
100	440/220	G.E.	600
100	440/220	G.E.	900

SYNCHRONOUS MOTORS 3-Ph., 60 Cy.

HP	Volts	Make	Type	RPM
400	440/220	G.E.	ATI	600
300	2300/400	G.E.	TS	720
300	440/220	G.E.	ATI	600
250	440/220	Whse.	HR	327
250	440/220	G.E.	ATI	600
250	4000/2300	El. Mchy.	Syn.	600
240	2300/440	G.E.	ATI	720
200	4150/2300	Whse.	G	1800
130	440/220	G.E.	ATI	900
110	440/220	G.E.	TS	257
100	440/220	Whse.	G	1800
75	2200/440	Whse.	GE	600

PLATING UNIT

1—5,000 amp., 4/6 volt (or 2,500 amps., 8/12 volts) A.P. Munning, double commutator dir. conn. to 50 hp, G.E. sq. cage motor.

CIRCUIT BREAKERS

2—2000 amp., GG E, 5 pole, 600 v., air
2—1600 amp., ITE, 3 pole, 600 v., air
2—1200 ampere, Whse., 5 pole, 600 v., air
1—400 amp., 37500 V., G.E., Type FHKO-238 outdoor type, high interrupting capacity.

SQUIRREL CAGE MOTORS

HP	Volts	Make	Type	Speed
650	440	G.E.	FT	3600
500	2200/4000	Elliot	SC	1800
350	2200	G.E.	KT	1200
300	2200	G.E.	FT	3600
250	440	G.E.	IK	720
250	2200	Al. Chal	AR	1800
200	2200	G.E.	K	200
200	440	G.E.	IK	720
200	440	G.E.	IK	514
200	440/220	Whse.	CB	1200
200	440/220	G.E.	KT	1800
150	440	multi sp.	KT	1800/600
150	440/220	Whse.	CS	900
150	440/220	G.E.	IK	450
100	2200/550	Whse.	CS	900
150	440/220	G.E.	KT	720
150	440/230	Howell	B. Brg.	1800
150 vert.	440/220	G.E.	KTP	1200
150	440/220	G.E.	IK	514
100	2200/440	G.E.	KT	600
100	2200/440	G.E.	K	1200
75 (5)	550	G.E.	KF	1800

A. C. GENERATORS

1—320 kva, 660 rpm, 2300/440/220 V., G.E.
1—275 kva, 1200 rpm, 440 V., G.E.
1—250 kva, 720 rpm, 2300/440 v., G.E.
1—225 kva, 600 rpm, 220/440 v., G.E.
1—187 kva, 1200 rpm, 440 V., Whse.
1—150 kva, 900 rpm, 480/240 v., G.E.
2—100 kva, 720 rpm, 440 V., G.E.
3— 75 kva, 1800 rpm, 480/240 v., Whse.

D. C. MOTORS

HP	Volts	Make	Type	Speed
250	230 (2 new)	Cr. Wh.	CMC	1500
225	230	G.E.	CD	600
150	236 (2)	Whse.	SK	850
125	230	Whse.	SK	250/1050
100	230	El. Dyn.	30-3	475/1250
100	230	Cr. Wh.	CMC	625
100	230	G.E.	CD	1750
75	230	G.E.	CD	1150
75	230	Whse.	SK	850

MOTOR GENERATOR SETS

1—250 kw, 1200 rpm, 250 V., Whse., conn. to 375 HP, 1200 rpm, 2200 V., syn.
1—175 kw, 1200 rpm, 230 V., G.E., conn. to 250 kva, 1200 rpm, 2200/440 V., syn.
1—100 kw, 1200 rpm, 240/120 V., Al. Chal., conn. to 150 hp, 440 V., sq. cage.
1—75 kw, 125 v., 1200 rpm, G.E. conn. to 120 hp, 2200/600 v., sync. motor.
1—65 kw, 1200 rpm, 250 V., G.E., conn. to 100 hp, 1200 rpm, 440 V., synchronous.
1—50 kw, 250/125 V., 1200 rpm, 3-wire, G.E., conn. to 75 hp, 440/220 V., sq. cage.

TRANSFORMERS 60 CY.

3—333 kva, G.E., 13,200—2300 V.
1—300 kva, Al. Chal. 4600/4160—240/120 V., 3 phase
3—250 kva, G.E., 2400-480 volts.
3—250 kva, Whse., 11,000/22,000—2300 V.
3—200 kva, Whse., 2400—240/120 V.
1—150 kva, Whse., SK, 13200-125/215 v., 3 ph.
3—150 kva, Al. Chal., 2400-240/120 V.
3—150 kva, Whse., 2400-240/480 V.
3—100 kva, Whse., 2400-240/480 V.
6—100 kva, Whse., 2400—120/240 V.
5—100 kva, G.E., 4150—120/240 V.
2—100 kva, Whse., 2400—120/55 V.
3— 75 kva, Whse., 2400—240/480 V.
3— 75 kva, Moloney, 4150—240 V.
6— 50 kva, G.E., 2400—120/240 V.
11—50 kva, Whse., 2300-110/220 V., dry.

STEPHEN HALL & CO.

HARRY J. RICE PRES.

458 SEVENTH ST. HOBOKEN, N. J.

3—500 H.P. 450 Lb. B&W Sectional Header Water Tube Boilers, Complete with Stokers, Superheaters, Boiler Feed Pumps, and all Miscellaneous Equipment.
2—250 H.P. Erie City 3 Drum Low Head Boilers, 1942, 200 Lb. Working Pressure, Peabody Burners, Brooks Control Equipment, Pratt-Daniel Stack on each Boiler Pumps, Heater, and Piping.
1—250 H.P. Union Iron Works, 200#, Universal Economic type.
1—600 H.P. B&W Sect. Header Boiler, 200#.
1—150 H.P. Bros 150# w.p., 3 drum, Bent tube, self contained, steel encased, brick lined. 9000# steam per hour.
General Scotch Marine Boilers, 75 to 150 H.P. available.
1—500 H.P. Cleaver Brooks Package Boiler, 150 Lbs. #6 Oil, 1947.
A Number of Self Contained & Economic Units, 50-150 H.P., 100-200 Lbs. Pressure.
Combustion Engrg., Spreader Stoker complete with fan & Hagan Controls-Stoker. Designed for 600 H.P. boiler at 200% of rating, or 1200 H.P.
1—6 Cylinder Enterprise Diesel, 800 H.P. direct connected to 1000 K.V.A., 3 ph., 60 cyl., 2400 V. Elliot Generator complete with all aux. Unit built 1948, 1400 hrs. use only.

WARNER J. SHERB, INC.
342 Madison Avenue, New York, N. Y.
Telephone MUrray Hill 2-9098

50 hp BOILER

Combustion Engineering No. 445 Boiler —CODED NUWAY—48 in. x 12 ft.—Return Tubular Horizontal. Two injectors. Twin Safety Valves, blowoff valve and whistle. Tubes 3" x 12', 30" dia. x 60' steel stack. No. 3D Iron Fireman Stoker. 1200 lbs. hopper capacity. 2 hp Allis-Chalmers 440 volt 3 phase, 60 cycle, 1750 rpm motor. Automatic controls, mercury low water cut-off, line starter with built-in relay, pressure and water gauge column, etc.

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METAL & THERMIT CORPORATION
JOHN W. ADAMS, Agent
Roseland, Nelson Co., Va.

FOR SALE
1000 AMPS 3 POLE DUCT
Manufactured by Square Deal Mfg. Co.

10 Pcs.	FD	1341-1000A—3'Pole Duct 10"
1 "	FD	1341-8-1000A—3 Pole Duct 8"
1 "	FD	1341-7-1000A—3 Pole Duct 7"
3 "	FD	1341-6-1000A—3 Pole Duct 6"
1 "	FD	1341-LH ELL
1 "	FD	1341-LV ELL
1 "	FD	1341-E END TAP BOX
1 "	FD	1341-L SQ-D—VERTICAL ELBOW WITH FANGED END on 36" LEG
1 "	FD	1341-SQ-D HORIZONTAL ELBOW WITH FANGED END ON 18" LEG
2 "	FD	1341-W WEATHER PROOF DUCT 10
2 "	FD	1341-8 W WATER PROOF DUCT 8'
1 "	FD	1341-7 W WATER PROOF DUCT 7'
1 "	FD	1341 EW
1 "	FD	1341-06VS FOR 1200-A 3-P

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PAOLI, INDIANA

BRIDGE CRANE

10 Ton Whiting Pushbutton Floor operated, three motor Bridge Crane, AC 220 Volt 60 cycle, 3 phase 25' 8" center of rail distance. Good condition as removed from service. Ideal for granite works, or heavy machine shop service.

SUPERIOR NORTH SHORE POWER CO.
Stores Dept., Lutsen, Minnesota

FOR SALE

Used Equipment—Good Condition

Inspection Invited

EVAPORATING & CRYSTALLIZING PLANT—7 Swenson Calandria type Evaporators and one Vacuum Crystallizer, two stage. Complete plant with pumps, etc., on steel structure.

POWER PLANT—3—500 HP B & W Sterling type Boilers, complete aux. equip. Also 2 Waste Heat Boilers, same type. 1250 KVA 440 V. Generator direct connected G.E. Steam Turbine, switch board and aux. equip. Also steam driven C.P. Air Compressor size 12" x 14" x 11".

Write for Particulars

MANGANESE, INC.
P.O. Box 2008 HENDERSON, NEV.

DIESEL ELECTRIC PLANT

520 HP, FM Mod. 31-A 8½-AC, 514 RPM, 412 KVA, FM, Type TGZJ, 3/60/2400, Generator. Switchboard and complete plant auxiliaries. New 1949, Used less than 2100 hours. Can demonstrate on foundation.

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14456 Glastonbury Detroit 23, Michigan

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Ingersoll-Rand Horizontal two stage compressor with 150 H.P. G.E., slip ring motor. 500 C.F.M. Capacity and controls.

UNION BUILDING & CONSTRUCTION CORP.
631 Main Avenue Passaic, New Jersey

TRADE WITH BAUER
BUY - SELL - TRADE
your
COMPRESSOR VACUUM PUMP STEAM BOOSTER
L.W.BAUER
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ELECTRICAL CABLE

- for every Industrial and power application
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- Cut to length. Reasonably priced.

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Advertise it in the
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GARDNER DENVER—horiz. Duplex Type (3); like new; 2—Mod. HAF10-10; 1545 CFM @ 274 RPM; 5 step control; 250HP 3/60/2300/4160 volts; Cost new $23,135. PRICE ..... $17,000 ea.

1—Mod. HAE10-34; 1170 CFM @ 300 RPM; 5 step control; 200 HP 3/60/2400-4160 volts; cost new $19,160. PRICE: $14,000

1200 CFM INGER. RAND. Type XVO Diesel Driven Compressor, good condition $9,950

OTHER COMPRESSORS AVAILABLE FOR SALE

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100 KW GENERATOR SET

BUCKEYE DIESEL 400 RPM 3/60/240 with V-Belted exciter, Switchgear, Voltage Regulator, Oil filter, Silencer, Water Pump. Engine overhauled.

Immediate delivery—Priced to Sell

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2 ea. #590 Kewanee 2-pass firebox boilers 100#, ASME, with stokers 75% saving.

New Boilers at a Great Saving—
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1—400KW horizontal G.E. alternator 3 ph. 60 cy. 2300V 180 RPM only $1,000. Exciter $200.
1—Vertical G.E. 144 KW 3 ph. 60 cy. 240V 120 RPM with 72" Smith turbine for 9' head $2500.
1—Comp vert unit 240 KVA 3 ph. 60 cy. 2300V 225 RPM. Exciter on top. Leffel Z 27" turb. 17' hd.
1—250 KW vert unit 3 ph. 60 cy. 250V 600 RPM with Smith ad blade turb. Exciter on top. 29' hd.

WM. C. MOULTON ASSOCIATES, Monson, Mass.

FOR SALE

Nordberg—G.E. diesel-elec. generator set, 875 KW.
Cooper Bessemer 1000 HP diesels, rev., new (2).
A-C 625 KW turbo-generator, 440 v., condensing.
1000 KW, 400, 300, 150, 100 KW generating sets.
Locomotive cranes, 40-ton diesel; 18-ton gas.
Whirley portal gantry cranes, electric (4).
Locomotives, 7 to 80 tons, diesel, gas, steam.
Crawler cranes, power shovels, diesel, elec. (10).

H. Y. SMITH CO.
828 N. Broadway Milwaukee 2, Wis.

AIR COMPRESSOR

1200 CFM—Sullivan WN-31, 100 PSI, direct connected angle compound, 20 x 12 x 14, with Sullivan after-cooler. Air filter, etc., direct connected to 213 HP, G.E. syn. motor 3-60-220-257, 80% P.F. with full voltage syn. motor starter and 7½ KW M.G. Set—Excellent.

TARPY ELECTRICAL MACHINERY
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FOR SALE

WATER WHEEL PLANT 312 KVA 550/3/60 29 foot head.
2—180 KVA UNITS 2300/3/60—85 to 200 foot head.

SOUL CLINIC, INC.
Calgary, Alberta, Canada

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in

New and used equipment recently released from service by a number of electric and gas utility companies

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TURBINES FOR SALE

1—Westinghouse Steam Turbine. Purchased in '21, used until '38. Requires some work to put in safe operating condition. Inspection requested. Location Muscatine, Iowa.

4—Type 2 BY, 125# pressure Elliott Steam Turbines, Serial Nos. 5733, 34, 35, 36. All complete with governors, discharge ells, expansion rings and in very good condition. Purchased in '37 but have had little service.

2—Dean Hill Turbines, Serial Nos. 109505, 506. Purchased '43. 25 HP 80# pressure. All are located at Fremont, Ohio and inspection desired.

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H. J. HEINZ CO.,
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our warehouse stock of engines, generators, switchboards, valves, pipe, separators, motors, MG sets, blowers, fans and all engine room equipment at prices to move fast.

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EXCELLENT POWER UNITS

2—125 KVA Westinghouse AC generators, 440 Volts, 277 RPM. Powered by 2 Bruce Mac Beth gas/gasoline engines.
1—150-HP, 225 RPM, Synchronous motor. Real Bargains.

A A A IRON CO.
Caston & Hawkins Sts., Dallas 1, Texas

43rd YEAR —:— 43rd YEAR
MOTORS & GENERATORS, etc.
1 YEAR GUARANTEE

Partial Listing Only!

GENERATORS—250 V. D.C.

KW	Make	Type	Speed
500	G.E.	MPC	900
300 (2)	G.E.	CY-272	1200
400	Elliott		1200
250	Cr. Wh.	Syn.	1200
200	Delco		1200
150	West.	SK	900
125 (2)	G.E.	MPC	1200
100	West.	SK	1200
75 (2)	Cr. Wh.		1200
50	West.	SK	900
10	West.	SK	1150
30	ABSce	5V623	1150
30	G.E.	TC95-4	1800
25	G.E.	RC	1150
20	Watton	D	1150
15	Star		1750
10	G.E.	RC	1150
7½	West.	SK	1750

GENERATORS—125 V. D.C.

KW	Make	Type	Speed
150 (2)	West.	SK	1200
100	El. Mchy.	651-T	1200
100	G.E.	RC	1200
100 (3)	West.	SK	900
100	G.E.	MPC	900
75	G.E.	DAC	1150
60 (2)	West.	SK	1800
50	G.E.	RC	1150
50	Cr. Wh.	CCD	1160

GENERATORS—600 V. D.C.

KW	Make	Type	Speed
400 (4)	G.E.	MPC	1200
325	G.E.	MPC	1200

LOW VOLTAGE D.C.

Amp.	Make	Voltage
10000	J-L	2/10
7500 (2)	Nor.	7½
5000	HVW	6
2500	Chandev.	6/12
500	Chandev.	12
1500	Century	24
600	West.	32
1000	Century	32
1000	Chandev.	40
1500	Century	40
1500	G.E.	50
1000	G.E.	60
1000	G.E.	75

MOTORS—230 V. D.C.

H.P.	Make	Type	Speed
187½	G.E.	MDS	435
150	Sprague	L4	1700
100	Al. Ch.		1150
100	F-M	TRC	725
100	G.E.	RC-56	775
90/45 (2)	G.E.	RP-17	950/450
75	Cr. Wh.	CMC-125H	375/950
60	West.	SK	690
60	West.	SK	250/1000
50	G.E.	CD-93	3600
50 (2)	West.	SK	565
50	G.E.	RF	250/1000

FREQUENCY CHANGERS

KVA	Make	Type	Output Frequency
231	G.E.	ATB	150 cy.
150	G.E.	ATB	150 cy.

MOTORS—Squirrel Cage

H.P.	Make	Type	Speed
250	G.E.	KT259	1750
200	Wagner	RP-2	1800
200	G.E.	KP	880
200 (2)	Al. Ch.	AR	870
200	G.E.	KG	700
150	Wagner	31VRN	900
150	West.	CS	600
125	Al. Ch. (5)	AR	1150
125	G.E.	IK	1150
100	G.E.	KT	1800
100	G.E.	IK	1750
100	West.	CS	1750
100 (2)	Al. Ch.	AR	1150
100	G.E.	K	1175
100	West.		870
75 (2)	West.	CS	1750
75	G.E.	KT	900
75	West.	CS	720

MOTORS—Slip Ring

H.P.	Make	Type	Speed
500	Elliott		1180
500 (2)	G.E.	TM	450
400	G.E.	TM	900
400	West.	CW	577
250	G.E.	TM	435
200 (2)	G.E.	TM	1170
200	G.E.	MT	1175
125	West.	CW	1750
100	G.E.	MT	1150
75	G.E.		1750
75	Lincoln		1750
75	G.E.	MT	900
75	West.	CW	690
60	G.E.	MT	1720
60	West.	CW	290

MOTORS—Synchronous

H.P.	Make	Speed
475	West.	720
300	G.E.	900
200 (2)	G.E.	900
200	Burke	900
180	G.E.	900
165	G.E.	1200
150	G.E.	900
150	G.E.	720
75	G.E.	900

Please Send Us Your Inquiries

L. J. LAND, INC.
Established 1910
150 GRAND STREET, NEW YORK 13, N. Y.
CAnal 6-6976

ADVERTISERS' INDEX

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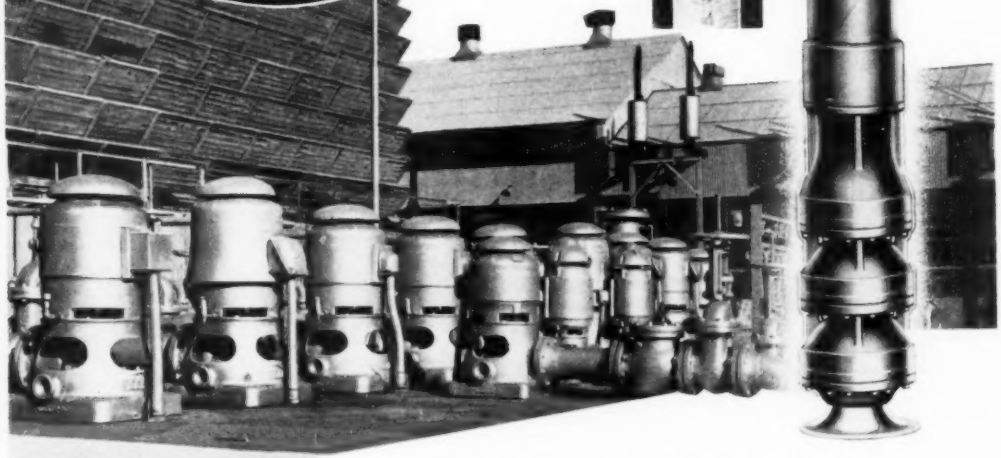

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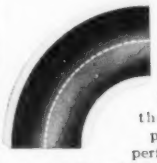

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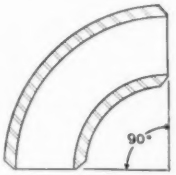

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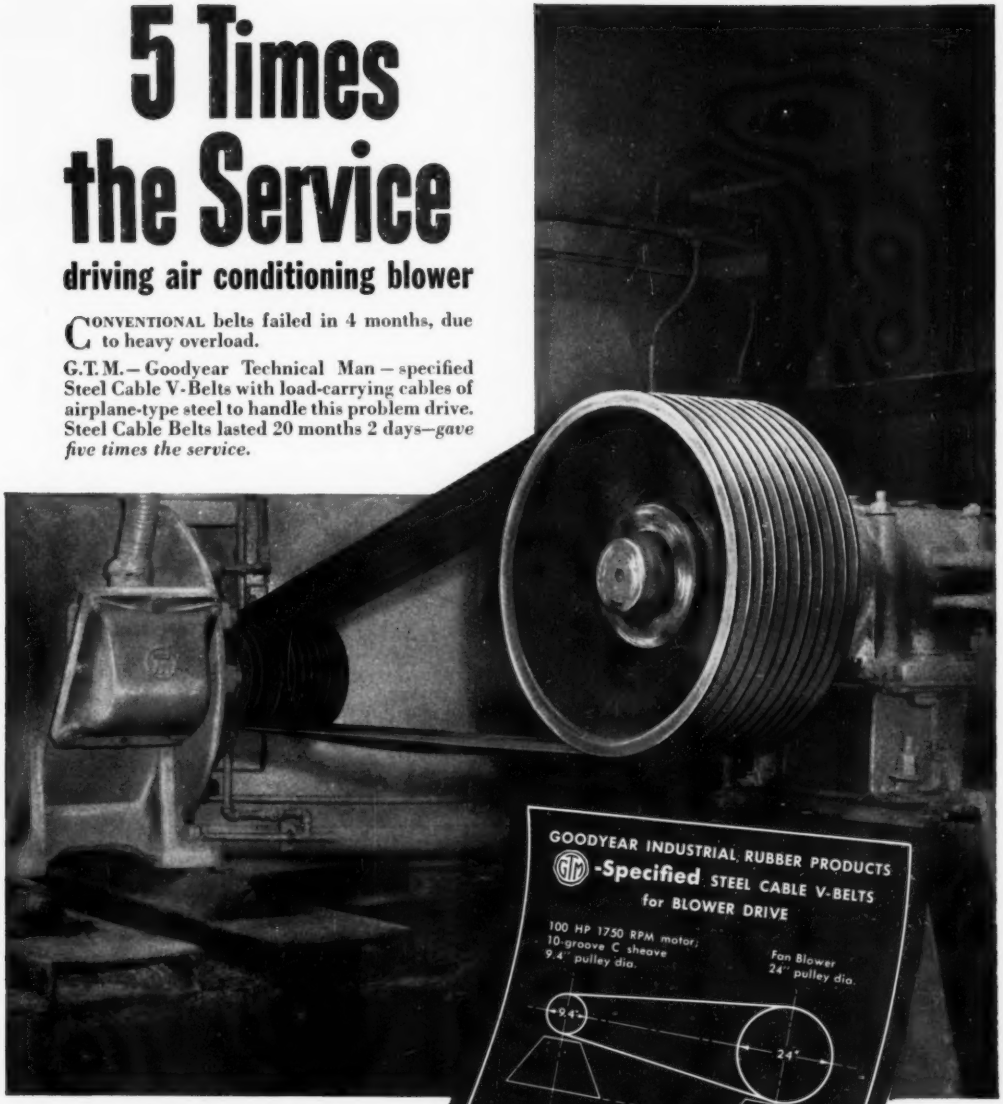

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